# Heating Piping & Air Conditioning

DESIGN
INSTALLATION
OPERATION
MAINTENANCE

NOVEMBER ★ 1950

INDUSTRIAL
COMMERCIAL
INSTITUTIONAL AND
PUBLIC BUILDINGS

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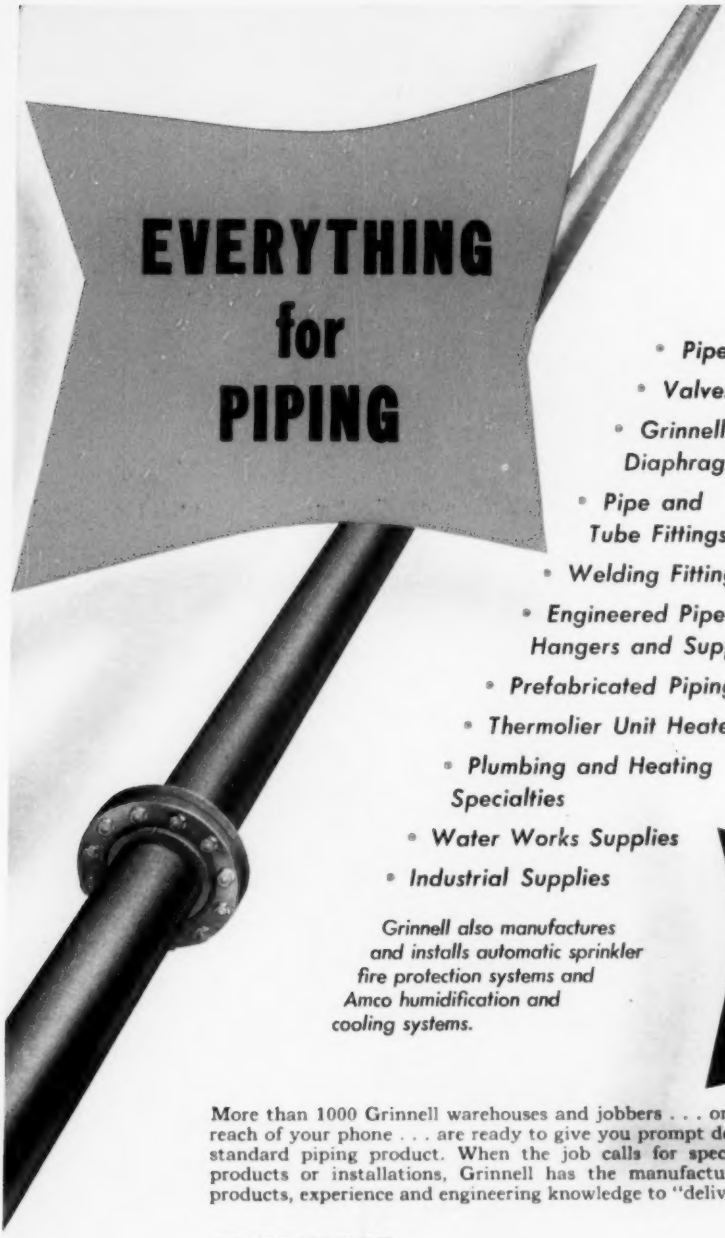

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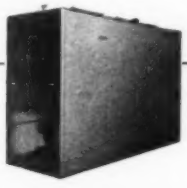

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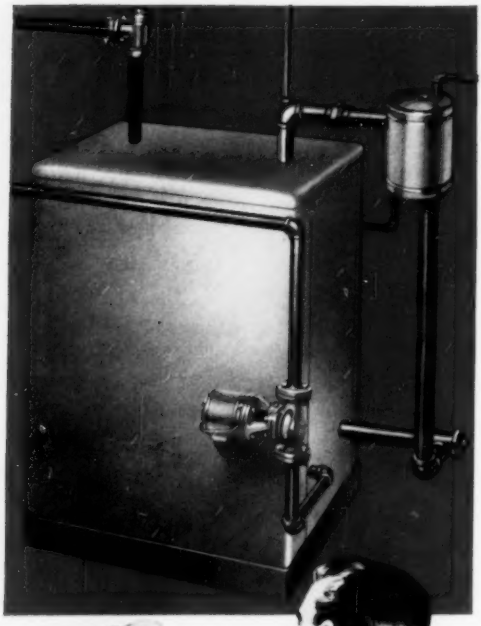

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(with which is merged the Aerologist)

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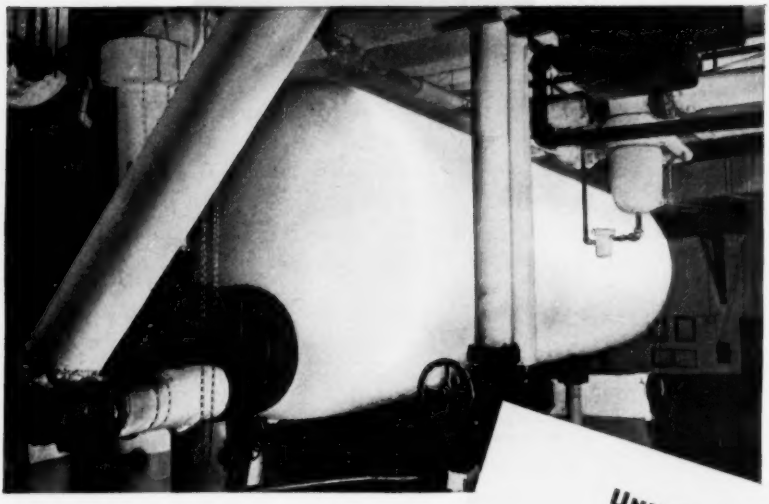

***Mr. Spallholz says it better than we can!***

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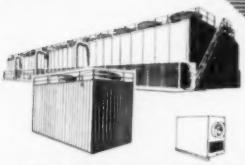

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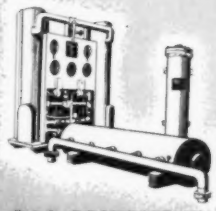

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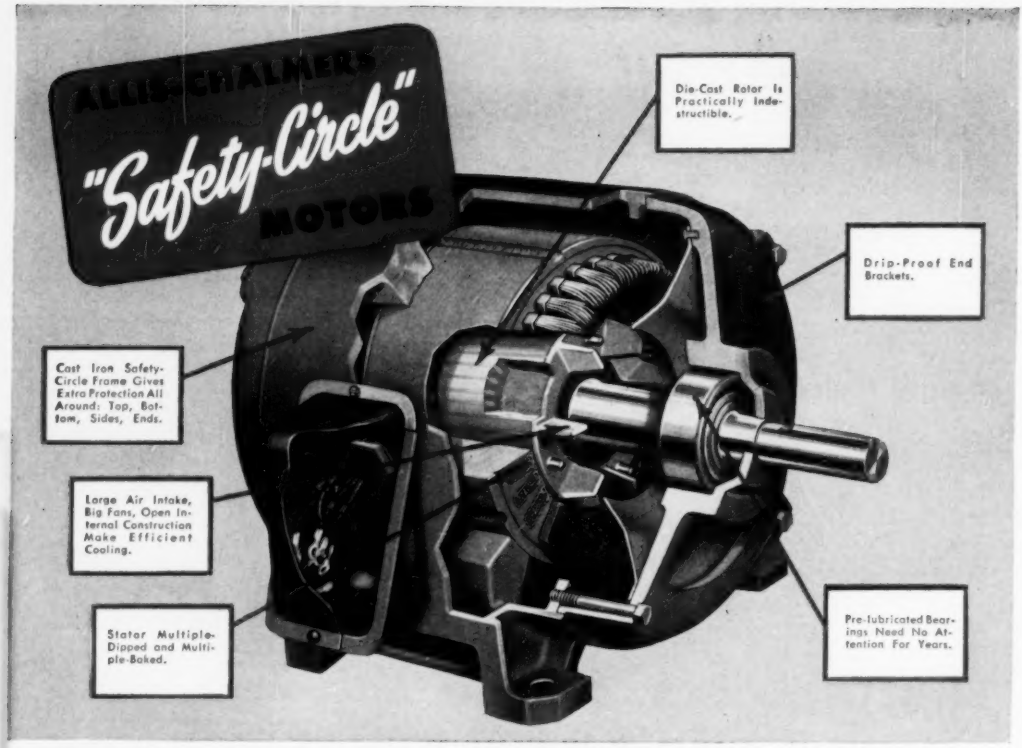
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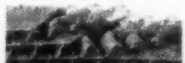

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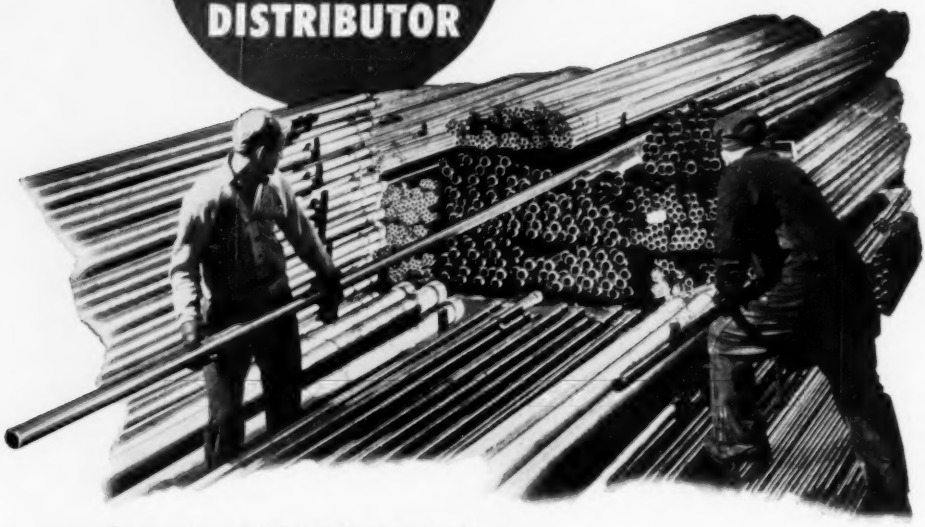

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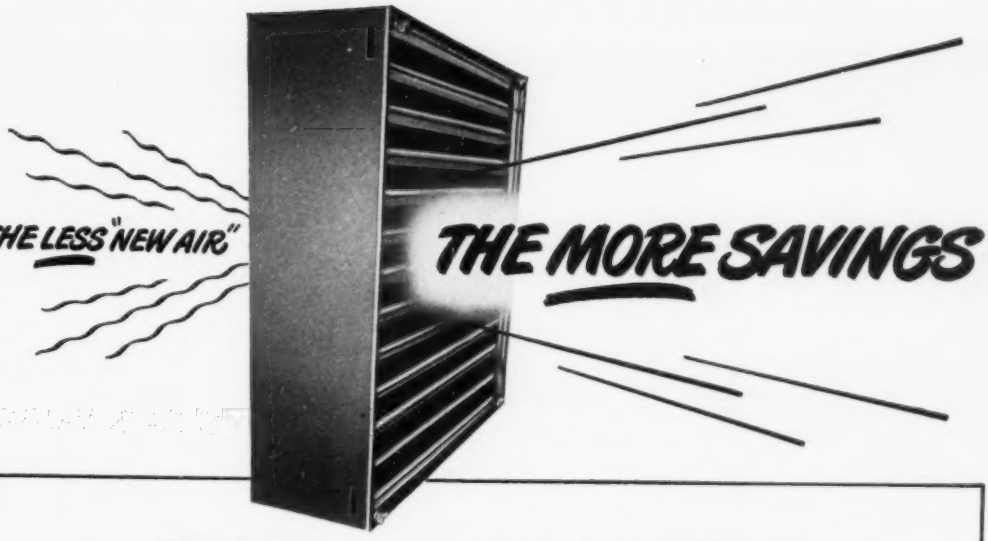


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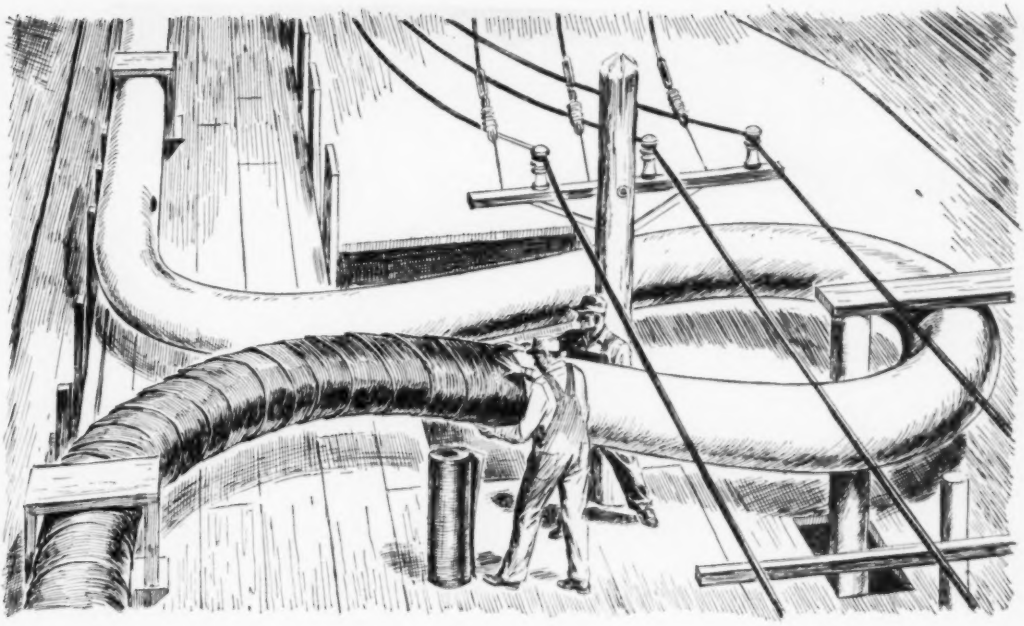

# What's wrong with this picture?

There's nothing wrong with weatherproofing an outdoor steam line with roofing paper—as far as the straight sections go, but on the expansion loop, this method won't work so well.

Roofing paper can be wrapped smoothly and wired in place around straight runs of pipe covering, but, on any curve, the edges of the paper flare out instead of hugging the line snugly. The paper gapes, forms pockets which catch rainwater, and wind getting under the paper can soon tear and loosen it.

A plastic coating like Armstrong's Insulmastic is more efficient on bends and loops. First, two coats of asbestos cement are applied over the covering. The second coat is left rough to key with the first of two coats of Insulmastic which follow. No painting or further finish is required.

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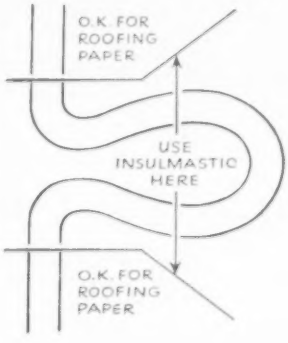


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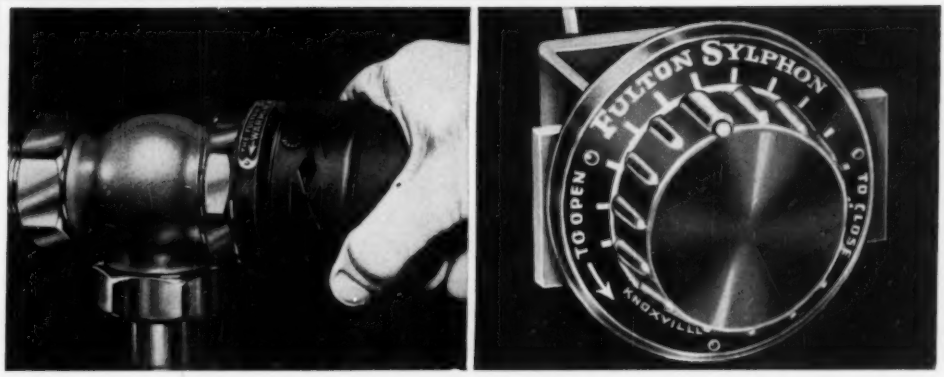
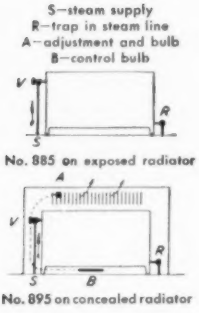
# Low Cost room comfort




*Illustrated—two basic types of Sylphon automatic radiator valves. Left, for exposed radiators. Right, for enclosed radiators. Both available in globe and angle bodies.*

## Sylphon Automatic Radiator Valves— for economical, uniform temperature control!




HERE'S the money-saving answer to the problem of too much or too little heat—with its discomfort and costly waste of fuel and employee efficiency. Sylphon Automatic Radiator Valves assure positive, uniform temperature control at *all* times—in one room, an office or entire plant. They save building operators and owners *plenty*—for studies show that during 95 per cent of the average winter season, more heat is generated than needed for health and comfort.

Sylphon Automatic Radiator Valves cost less than any other automatic controlling system available. They're easily and quickly installed on your present equipment. Simple in construction, self-powered, packless—self-contained and fully modulating. They pay for themselves many times over in fuel savings alone.

Right now is the time to install them —start saving the minute you use them. For complete information, send for Bulletin VH-80.

FS
FIRST WITH BELLOWS

*Temperature Controls • Bellows Devices • Bellows Assemblies*

**FULTON SYLPHON**
DIVISION

ROBERTSHAW-FULTON CONTROLS CO. KNOXVILLE 4, TENN.

*Canadian Representatives, Darling Brothers, Montreal*

MORE OF

THE COUNTRY'S

LEADING BUILDINGS USING "Buffalo" FANS

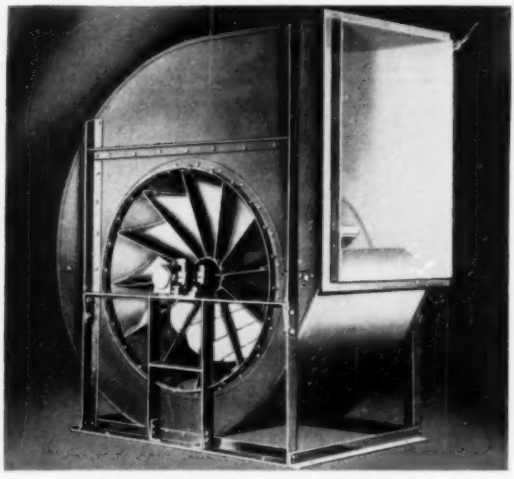
# "Buffalo" FANS

## HELP MAKE CHESTERFIELD CIGARETTES

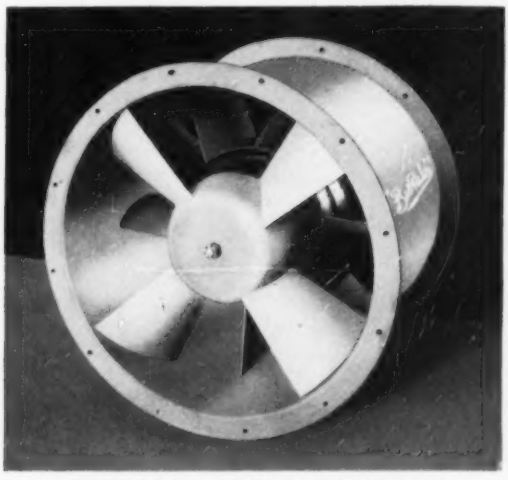
"Dedicated to the millions who smoke the Cigarette That Satisfies", this new Cigarette Factory and Research Laboratory of Liggett & Myers Tobacco Company, Durham, N.C., are the two most modern buildings in the business.

Important to the high degree of efficiency in both these buildings is perfect control of air conditions. And "Buffalo" Fans supply the dependable "air power". Here is another of the country's leading firms whose building expansion plans have included "Buffalo" Fans. And small wonder—their seventy-two-year reputation for efficiency, easy maintenance and long life is known to engineers throughout the industry.

*Specify "Buffalo" for your next air handling job — and you can be sure of the results you hoped for! Write now for information on your particular air problem, and the units to handle it.*



"BUFFALO" LIMIT-LOAD FAN



"BUFFALO" AXIAL FLOW FAN

Buffalo "LL" and Axial Flow Fans meet all requirements for quiet, dependable work in both air conditioning and straight ventilation installations.

"Buffalo" FIRST FOR FANS

**BUFFALO FORGE COMPANY**

171 MORTIMER ST. BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

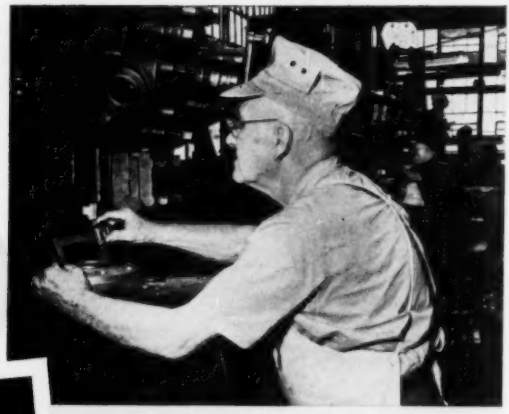
Branch Offices in all Principal Cities

# THEIR JOB is to help you get..

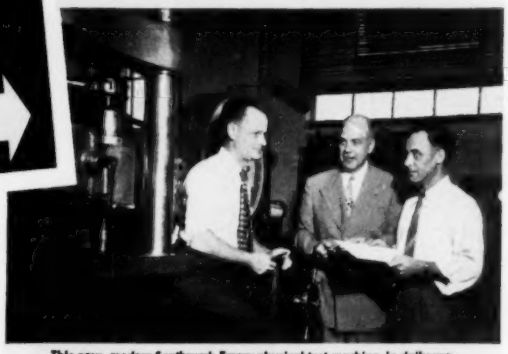
Precision Engineering of valve designs, Precision Manufacturing and Precision Application—OIC considers all three factors equally essential to good valving. OIC has the years of experience and the service organization to give you all three.

We point with pride to these veteran members of the OIC organization as evidence: Mr. Claude Waltz has been contributing precision machining for 54 years. Mr. D. B. Malaney, Metallurgist, Mr. H. G. Doster, Vice President in Charge of Engineering, and Mr. J. B. Turner, Product Engineer, combine 40 years of service in precision engineering. Mr. A. A. Kruse, Jr., who began in our Engineering Department, is now one of the many field engineers advising users on precision valve application in various parts of this country.

If you're needing valve *application know-how,* call the nearby OIC distributor for the help of a factory representative, or write direct to us. The Ohio Injector Company, Wadsworth, Ohio.



Mr. Claude Waltz, operating a Bullard high-speed boring mill here, started at OIC in 1896, at age 19, as an apprentice machinist.



This new, modern Southwark-Emory physical test machine, in daily use, is one of the many mechanical aids added to the 40 years of precision engineering experience of Messrs. Malaney, Doster and Turner.

Mr. A. A. Kruse, factory trained in precision application of valves, is one of many O. I. C. representatives in various parts of the nation qualified and available to aid both distributors and users in valve application.

OIC
FOUNDED 1883

**VALVES**

**FORGED AND CAST STEEL · IRON · BRONZE**

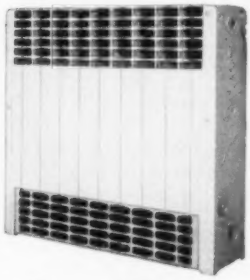
# AMERICAN-Standard

**First in heating . . . first in plumbing**

## *Here's easy, economical heating...*

■ Expertly engineered and sturdily constructed, the REDFLASH Boiler can be installed singly or in battery to provide an abundance of heat for large residences or commercial buildings of practically any size. Its scientifically proportioned combustion chamber, direct heating surfaces, and long flue travel for hot gases assure highest heat output with the least fuel. Burns low-priced fuels and can be readily adapted for automatic firing with oil burner, gas convertor or coal stoker.

Ask for detailed information about the REDFLASH and other large size heating units in the American-Standard line. Sold through selected Wholesale Distributors to Heating and Plumbing Contractors. **American Radiator & Standard Sanitary Corporation,** P. O. Box 1226, Pittsburgh 30, Pa.



**The SUNRAD Radiator**

Made of durable cast iron, the **SUNRAD** provides both radiant and convected heat. Its smart, simple lines blend nicely with any decorative scheme, making it an ideal unit for all types of residential or commercial buildings. Can be installed recessed, semi-recessed or free-standing.

*Look for this* AMERICAN-Standard HEATING PLUMBING *Mark of Merit*

## The Redflash Boiler *burns all fuels*

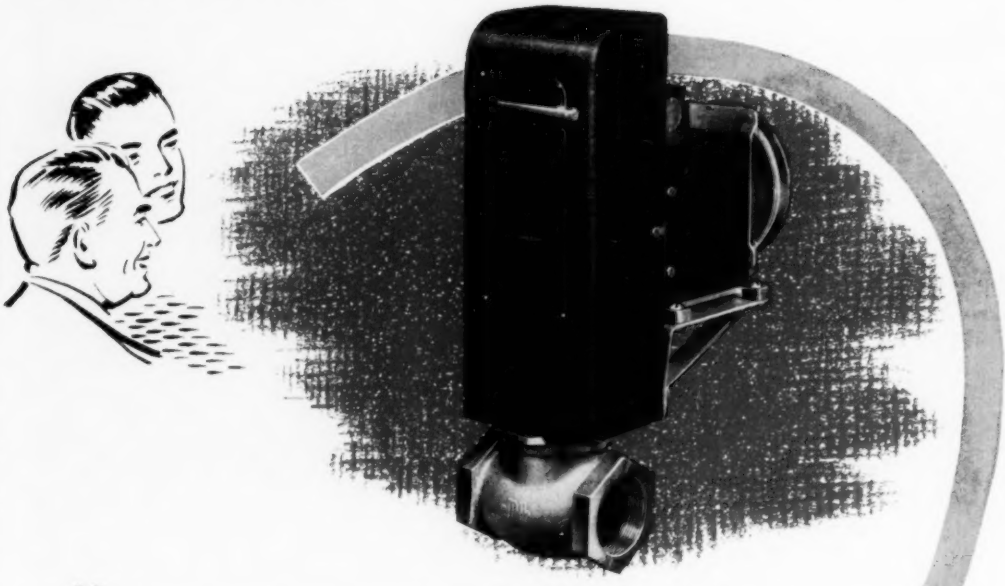
SHIPPED IN SECTIONS FOR EASY INSTALLATION

Redflash Boilers are shipped in sections, so that even the largest one is easily moved through a door or elevator. Can be assembled quickly without sending down walls or cutting floors. Complete.

*Serving home and industry*

AMERICAN-STANDARD • AMERICAN BLOWER • CHURCH SEATS • DETROIT LUBRICATOR • KEWANEE BOILER • ROSS HEATER • TONAWANDA IRON

# New Honeywell Spring Return Motorized Valve Permits Heat to Pass, Even Though Electric Power Fails



NOW, in a single, complete unit you get the dependable performance of Honeywell's famous motorized valve, PLUS positive protection against power failure from a powerful spring return mechanism. If the power fails, the spring return automatically positions the valve to full open — or full closed, as required. There is no external spring construction. And the new, more powerful motor has a 160-degree stroke.

Here's another instance of *Honeywell Superiority* — three-way superiority through dependable, trouble-free performance; simplified, all-in-one installation; and protection against any operating emergency.

It's this kind of practical approach — with the product made to fit the need — that has established *Honeywell Superiority*. It's reliable, year-after-year performance that has maintained *Honeywell Superiority*. Quite naturally, it's this superiority that makes Honeywell the leader in automatic control. Minneapolis-Honeywell, Minneapolis 8, Minnesota. In Canada: Leaside, Toronto 17, Ontario.

MINNEAPOLIS
**Honeywell**
CONTROL SYSTEMS

72 BRANCHES FROM COAST TO COAST WITH SUBSIDIARY COMPANIES IN: TORONTO • LONDON • STOCKHOLM • AMSTERDAM • BRUSSELS • ZURICH • MEXICO CITY

# The bundle of sticks

A wise old man called his quarrelsome sons about him. Taking up a bundle of sticks, he commanded each in turn to break the sticks. All tried, but in vain, and said it could not be done.

"And yet, my boys, nothing is easier to do," said the father, as he undid the bundle and broke the sticks, one by one. "By this example, you can see that united you will be more than a match for your enemies; but if you quarrel and separate, your weakness will put you at the mercy of those who attack you."

The useful truth of this fable is just as timely today as it was when the Greek ex-slave Aesop told it 2,500 years ago. You, a patriot, believing in individual liberty and freedom for all, see our American way of life threatened by the menace of communism abroad and jeopardized at home by complacence, negligence, confusion and incompetence.

As a business leader in your own community, you have a particular responsibility to help unify your fellow citizens and guide their thinking and action--for the strengthening and preservation of the ideals that built America, in fact, made America the envy and goal of the very individuals now seeking to destroy it. *In Union there is Strength.*

## The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York
MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

RAILROAD TRACK SPIKES - CONDUIT - HOT AND COLD FINISHED CARBON AND ALLOY BARS - PIPE AND TUBULAR PRODUCTS - WIRE - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - RODS - SHEETS - PLATES.

# This Specialty Shop COMBINED Air Conditioning AND Winter Heating AND SAVED 38% by using a DRAVO COUNTERFLO HEATER

It's accepted as a merchandising "must" that better stores today have to provide summer air conditioning for customers as well as winter warmth . . . and the new Bramson Specialty Shop in Evanston, Ill., found a way to do it without the usual high cost and complication.

By using a Dravo Counterflo for winter heating, one set of duct-work serves the year-round, eliminating the cost and complication of a parallel piping system. All equipment is concentrated in a small utility area, readily accessible for adjustment or attention. The complete installation cost $14,000 less than the lowest bid on a wet-type heating system plus equivalent conditioning apparatus . . . a saving of 38%.

During the winter, heated fresh and recirculated air are automatically blended, balancing heat input to heat loss and maintaining selected temperatures in various locations with minimum fuel. In summer, air volume is increased by adjusting vari-pitch sheaves on the blower motor. Because of the stainless steel combustion chamber of the heater, conditioned air can be circulated through the unit without danger of corrosion. The ever-present problem of excess infiltration of air at entrance doors is solved by the use of ducts which discharge heated or cooled air into the entrance area. Aside from turning switches for winter or summer operation, control is completely automatic.

**DRAVO**
CORPORATION
DRAVO BUILDING, PITTSBURGH 22, PA.

If you have a heating-air conditioning problem, you, too, may find the Dravo Heater an ideal means of reducing installation, operation, and maintenance costs. Ask for a case history describing the Bramson installation in detail . . . and, for full data on the Dravo Counterflo Heater, ask for Bulletin IJ-523-9102.

DRAVO

Dravo also manufactures the *DRAVO CRANE CAB COOLER* for air conditioning hot-metal crane cabs.
**PITTSBURGH • CLEVELAND • PHILADELPHIA • DETROIT • NEW YORK • CHICAGO • ATLANTA • BOSTON**
Sales Representatives in Principal Cities. Mfd. and Sold in Canada by Marine Industries, Ltd., Sorel, Quebec
Export Associates: Lynch, Wilde & Co., Washington 9, D. C.

# NEW CONCEALED BEARING LOUVER SUPPORT

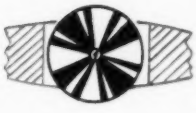
## GIVES YOU CUSTOM-BUILT GRILLES...IN ANY LENGTH...WITH NO MULLIONS...NO UGLY BUTTED CONSTRUCTION

(Above) Cut-a-way view of AIRFOIL louver showing special concealed bearing support. Note how bearing nestles in center of solid louver section.

# Airfoil

## AIR CONDITIONING OUTLETS

**END VIEW OF CONCEALED BEARING SUPPORT**

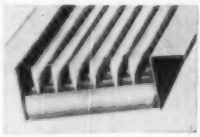


Louver rotates on cylinder bearing points. Sturdy steel support runs through center of bearing to entire width of grille.

**SIDE VIEW OF CONCEALED BEARING SUPPORT**

Rounded surface maintains valuable streamlining. Does not distort air flow. Affords *much extra strength . . . little added weight.*

**CUT-A-WAY VIEW OF ENTIRE GRILLE SECTION**



*Concealed bearing* does not break streamlined contours of AIRFOIL louvers . . . even when louvers are set to direct air stream straight from opening.

The AIRFOIL *SPECIAL, PATENTED BEARING SUPPORT* is the newest . . . *most revolutionary advance in air conditioning outlet design.*

Note how this cylinder is securely fastened in the interior of the solid section AIRFOIL louver . . . concealed . . . hardly breaking the smooth, streamlined contour of the louver. It allows quick, easy adjustment of the louver—permits AIRFOIL grilles to be custom-built *TO ANY DESIRED LENGTH OR WIDTH WITH NO MULLIONS, NO UGLY BUTTED CONSTRUCTION.*

Louvers in AIRFOIL grilles present an unbroken line from side to side.

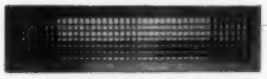
No other grille has the tremendous advantage of this exclusive *concealed bearing support.*

IN ADDITION, AIRFOIL GRILLES HAVE THESE PRIME FEATURES THAT GIVE YOU *MORE VALUE PER DOLLAR* PLUS *MAXIMUM PERFORMANCE.*

- **EXTRA WIDE BEVELED BORDER**
- **COUNTER SUNK SCREW HOLES**
- **SMOOTH—MITERED CORNERS**
- **UNIFORM LOUVER TENSION**
- **ATTRACTIVE, EXTRA-DURABLE FINISH**

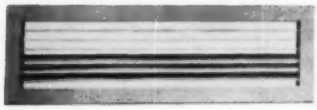
Remember—precision-manufactured AIRFOIL grilles work *right* from the very first—assure lasting customer satisfaction.

## A COMPLETE LINE



**L-2** 4-way directional outlet—2 sets extra deep louvers.

**L-8** Directional outlet—4 way—2 sets louvers ½" centers.



**L-1** High quality commercial type—1 set louvers set ½" centers.

**AF-325** 4-way comb. grille and vol. controller.

## FREE

Send for complete illustrated literature. Check box for special additional information.

- ☐ Air conditioning outlets
- ☐ Return air grilles and registers
- ☐ Volume controllers
- ☐ Perforated metal and ornamental grilles
- ☐ Door ventilators
- ☐ Special made-to-order grilles

**TITUS MANUFACTURING CORP. • WATERLOO, IOWA**

☐ Rush complete catalog. ☐ Send literature on above checked items.

Name_____

Address_____

City_____ State_____

# WORTHINGTON AIR CONDITIONING REPORT

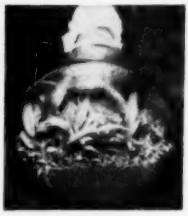
**WORTHINGTON PUMP AND MACHINERY CORPORATION**
**HARRISON, NEW JERSEY**

*Specialists in air conditioning and refrigeration for more than 50 years*

## Worthington Air-Conditions a "Jungle"

There is no such thing in the field of professional orchidology as a "Topsy" orchid. No prize beauty ever "jest grew." It takes large measures of patience, love and the nation's best horticultural brains to raise an orchid properly. At McKee Jungle Gardens, Vero Beach, Florida, one of the South's leading departments of orchidology under the direction of David C. Fairburn, PhD., has added air conditioning to the list of requirements for advanced orchid culture.

*Rare hybrid orchids must be planted in flasks of sterile food solution under carefully controlled conditions. At McKee Jungle Gardens, Worthington air-conditioning equipment provides precise temperature and humidity requirements for this delicate operation.*



*Properly controlled interior climatic conditions are the secret of successful development of orchid seedlings. The Worthington air-conditioning plant at McKee Jungle Gardens assures temperatures accurate to a fraction of a degree.*

Arthur G. McKee, owner of the project, has raised many uncommon hybrid orchids in greenhouses, developing new strains under controlled temperatures. Some of these have been developed to the point at which they withstand outdoor temperatures and may live year-'round in outside locations throughout the 80-acre Jungle Gardens area. But many rare strains of orchids spend their entire lives—and it takes an average of seven years for an orchid to mature—breathing conditioned air indoors.

At Vero Beach a large fortune in orchids is depending on Worthington air conditioning units. Perhaps the greatest single triumph for Worthington and McKee Jungle Gardens has been the successful raising of the ultra-rare Odontoglossum orchids. These are spray orchids native to 15,000 foot altitudes and low temperatures of the Andes Mountains in South America. Attempts to grow these orchids in the South—and in many parts of the North—have ended in dismal failure because the plants could not withstand radically hot summer temperatures. At McKee Jungle Gardens the Odontoglossums are living in a Worthington-made mountain atmosphere that has not only encouraged their healthy growth, but has also aided several complicated hybridizations. Future plans for the Odontoglossum call for a process of "air-conditioning the plants back to the outdoors," a process in which, through scientifically-plotted temperature changes, the plants can be made to adapt themselves to the normal outdoor climate of Florida and other southern states.

*Worthington Freon-12 condensing units and AHY air conditioning units at McKee Jungle Gardens*

### Another Big Store is Worthington-Conditioned

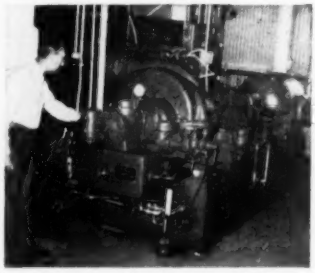
*J. L. Brandeis & Sons, Omaha, has installed a Worthington 67C9S centrifugal refrigeration system (647 ton capacity) for air conditioning the lower floors of this store building.*
*Engineering by Charles S. Leopold Company*

## No More "Wilted Violets" at the Detroit News

"I am sure it's a wonderful investment for efficiency and production. You should see how bright-eyed and happy the staff looks, whereas the last hot day we were a bunch of wilted violets."

That is a typical comment received by the management of The Detroit News shortly after installation of Worthington air conditioning.

*The Detroit News—publisher of the newspaper with the largest ABC-recognized home-delivered circulation in the country.*



*Worthington centrifugal compressor with condenser and cooler in Detroit News building.*

Every minute 240,000 cubic feet of cooled, freshened air is delivered throughout the building to air condition offices, press room and composing room. In the latter two rooms, humidity is carefully controlled, kept low in the composing room, and higher in the press rooms due to static electricity.

Source of the cooling is two Worthington centrifugal compressors, of 200 and 250 ton capacity.

Other Worthington equipment in the installation includes two coolers and condensers and water pumps.

**WORTHINGTON**

**AIR CONDITIONING AND REFRIGERATION**

A complete line . . . in which *all* the vital components are made, not just assembled by Worthington. For more worth with Worthington, see your nearby Worthington distributor (consult Classified Telephone Directory).

YOU CAN BE **SURE**.. IF IT'S

Westinghouse

**FOR AIR HANDLING**

# No dripping grease

## ...at *ANY* angle

Many fans and blowers, and considerable air-conditioning equipment must be installed overhead, high above the floor. Dripping grease can be a nuisance. And motors high up mean motors "hard-to-get-at". Lubrication is a problem, also.

That's where Life-Line motors offer an easy solution. Life-Line motors need no lubrication . . . are equipped with sealed bearings, pre-lubricated with a more-than-ample supply of specially treated lubricant.

To you, this means: mount Life-Lines vertically, horizontally, or any angle "in-between". Correct lubrication is positive. Grease is sealed in . . . can't drip.

Too, Life-Line is ⅓ smaller than conventional-type motors—a valuable asset when design allows limited space. Check other Life-Line advantages with your nearby Westinghouse representative. Ask him for a copy of the Life-Line booklet, B-3842 or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-21560

*—If you figure LIFE-COSTS . . . you'll figure LIFE-LINE—*

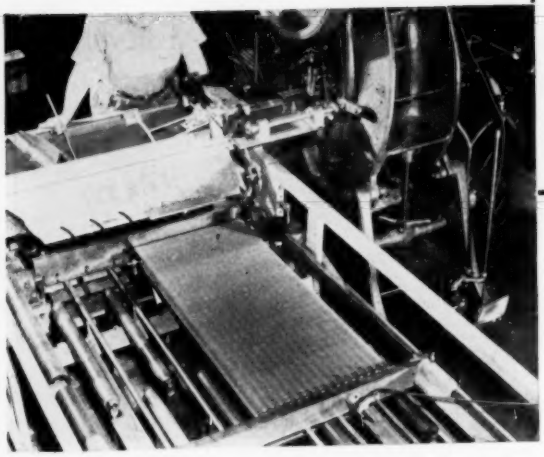
Westinghouse *Life-Line* Motors

INDUSTRY'S LEADING MOTOR

# *In cooling or heating coils*

**Sturtevant**

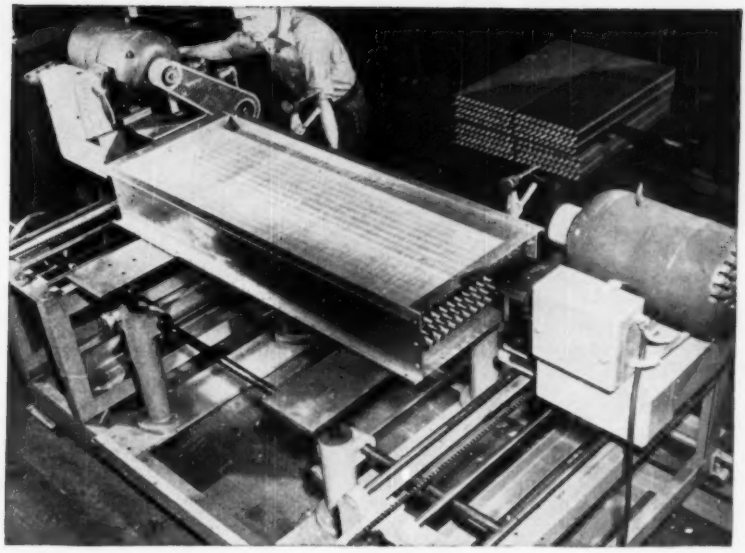
## GIVES YOU PROVEN PERFORMANCE



Specially-designed fin punching and stacking machinery makes possible high production along with high quality.

Uniformity of workmanship, quality, and performance are built into every Sturtevant coil.

Proper expansion of tubes provides best heat distribution to finned surfaces.



Special coil manufacturing equipment assures uniformity of coil quality and dependability.

*For practically every cooling or heating application*, you will find a Sturtevant coil that fills your needs. Because it is built under rigid specifications by skilled craftsmen using specialized equipment, it will be a quality product—with performance *proved* through years of successful installations.

Take the U. S. Department of the Interior Building in Washington, D. C., as an example. The thousands of Sturtevant coils installed there in 1934 have performed perfectly ever since. This is only one of many installations with a record of 15 years or more of efficient service.

Sturtevant's complete, standardized line contains all types and sizes of heat transfer coils. They are available in a wide range of capacities, with aluminum or copper fins that offer minimum resistance to air flow and are easy to clean.

By specifying Sturtevant, you are assured of long coil life at rated performance . . . the product of sound engineering, modern tooling and first-class workmanship. Call your nearest Westinghouse Sturtevant Office, or write to Westinghouse Electric Corporation, Sturtevant Division, Hyde Park, Boston 36, Massachusetts.

**YOU CAN BE SURE...IF IT'S**

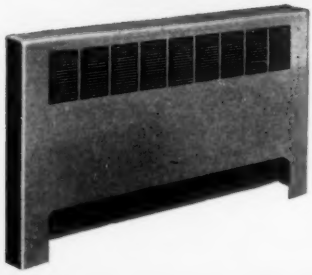
# Westinghouse

J-80167

# QUICK RESPONSE

fedders

## CONVECTOR RADIATORS



Made in a complete line of free standing and recessed models, combining handsome appearance, and uniform comfort. Easily installed in new or remodeling work.

fedders

## WALL RADIATION

Available in a wide range of lengths with expanded mesh, flat and sloping top cabinets for residential, institutional, commercial and industrial applications.

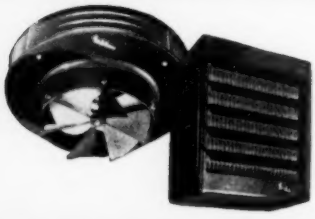
fedders

## BASEBOARD RADIATION

Features exclusive ANTI-STREAK COVER DESIGN which eliminates streaking of walls and draperies (patents pending).

fedders

## UNIT HEATERS



Made in a complete line of horizontal and downblow models ranging from 100 EDR up. Widely used throughout industry for heating in winter and air circulation in summer.

fedders

# another comfort and economy advantage of fedders HEATING EQUIPMENT for

## Home, Apartment, Business, Industrial and Institutional Use

Men who know heating are welcoming the quick response of Fedders high efficiency fin and tube heating elements. They are component parts of Fedders Convector-Radiators, Wall-Radiation and Baseboard Radiation. They provide quick warm-up and reduce time lag with resulting even firing curve so necessary under today's critical requirements for fuel economy. Overheating in off-season months and forcing of fire in severe weather are reduced because Fedders modern radiation equipment...

## Works Hand-in-Hand with Modern Thermostatic Controls

Handsome styling, space saving, light weight for easy handling combine to provide ideal installation for the ultimate in comfort. Fedders offers a complete line to fit household, commercial, institutional and industrial requirements.

*Write for Bulletins*

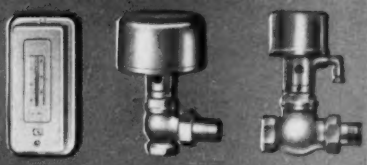
**FEDDERS-QUIGAN CORPORATION**

**BUFFALO 7, NEW YORK**

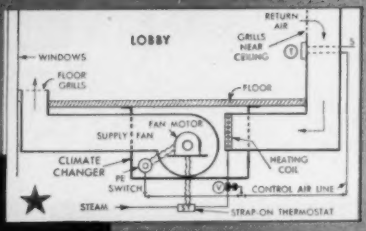
**Quigan**

Chemistry Building, Chicago

POWERS



Modern gradual acting pneumatic thermostats and control valves fit every requirement.




★ NOTE the novel solution to problem of supplying heat and ventilating in an unobtrusive manner. Strap-on-thermostat prevents operation of fan when no steam is available. Pressure electric switch stops fan after valve is closed.

Left, View from inside Metallurgical and Chemical Engineering Building shown below.

## ILLINOIS INSTITUTE of TECHNOLOGY

Architect
Ludwig Mies van der Rohe

Associate Architects: Friedman, Alschuler & Sincere; and Holabird & Root & Burgee

Consulting Engineer: Robert E. Hattis

Heating Contractor: Economy Plbg. & Heating Co., All of Chicago, Ill.

POWERS

**Pneumatic Systems of TEMPERATURE CONTROL are installed in the following buildings**

Chemistry Building • Metallurgical and Chemical Engineering • Institute of Gas Technology • Association of American Railroads • Alumni Memorial Hall • Network Calculator Laboratory • Sound Laboratory • Armour Research Laboratory • Machinery Hall

In 1990 will the Powers installations at Illinois Tech still be giving dependable control?... Nearby, in the Drake Public School, a Powers pneumatic system of temperature control is still giving reliable service after 49 years.

Many users report 25 to 40 years of low cost control from Powers regulation. So, with the better modern equipment now being used, 1990 may be only the half-way mark for present day Powers systems.

When you want temperature control that will provide maximum comfort and fuel savings with lower operating and maintenance cost, contact Powers nearest office. There's no obligation.

## THE POWERS REGULATOR CO.

Established 1891 • OFFICES IN OVER 50 CITIES • See Your Phone Book

CHICAGO 14, ILL., 2720 Greenview Ave. • NEW YORK 17, N.Y., 231 E. 46th St.
LOS ANGELES 5, CAL., 1808 West 8th St. • TORONTO, ONT., 195 Spadina Ave.
MEXICO, D. F., Edificio "La Nacional" 601

(RCIT)

POWERS MASTER-SUB-SYSTEM OF CONTROL FOR FORCED HOT WATER HEATING SYSTEMS.

# THRUSH

## *Vertical* FLOW CONTROL VALVE

WITH AIR TUBE

## *a New Design*

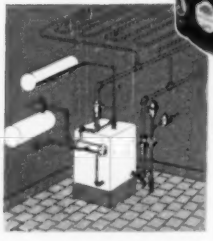
### TO SAVE FITTINGS, SIMPLIFY INSTALLATION

**HERE IS the Vertical Thrush Flow Control Valve. It has the same proved dependable construction and offers all the advantages of the angle type Thrush Flow Control Valve, but in many installations the vertical valve will save fittings and simplify installation. Like the standard valve, it provides both flow control and air elimination without requiring any "air tube" fitting. The air is automatically separated as it rises from the boiler water and vented directly into the pressure tank. Water free of air passes up inside the tube.**

Available with or without brass air vent tube.

With or without vent tube.

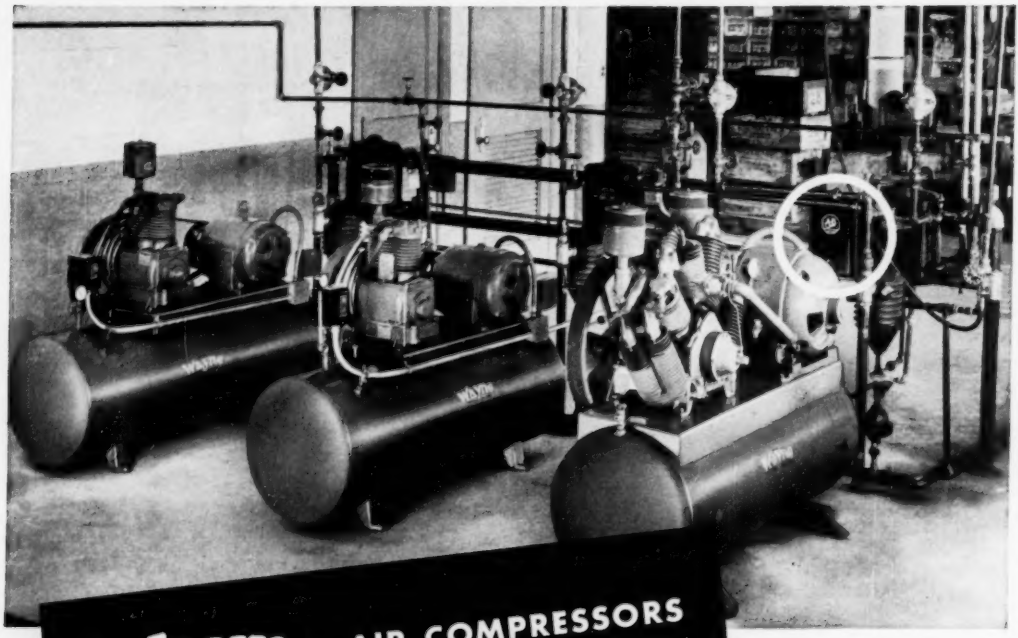
Angle type Flow Control Valve.



Thrush Horizontal Water Circulator.

**YOU SAVE installation time and assure better heating plant operation for your customer when you install Thrush "T" Flow Control Valves. If you are not familiar with the Thrush Flow Control System and heating specialties, ask your wholesaler about them today or write us for price sheet and illustrated bulletin on Flow Control Valves. Address department E-11.**

**H. A. THRUSH & COMPANY, PERU, IND.**



# Wayne AIR COMPRESSORS equipped with ALLEN-BRADLEY TROUBLE FREE MOTOR CONTROLS

Wayne Industrial Air Compressors in the Steel Products Manufacturing Company, St. Louis, Mo.

A-B Quality

Why are Allen-Bradley starters so popular for refrigeration and air-conditioning service? . . . Because they are trouble free. Only ONE moving part. No pivots, pins, or bearings to corrode or stick . . . no jumpers to break. You install them . . . and forget them!

No contact maintenance . . . Allen-Bradley patented silver alloy contacts never need cleaning, filing, or dressing.

Dependable overload relays . . . Allen-Bradley thermal relays are accurate and always dependable . . . even after long service.

The Allen-Bradley trade-mark stands for millions of trouble free operations.

Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.

**ALLEN-BRADLEY SPECIAL REFRIGERATION CONTROL UNIT**

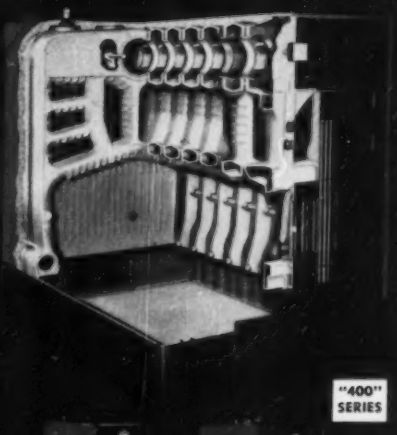
Allen-Bradley offers a wide line of air-conditioning and refrigeration controls—pressure and temperature controls, manual and automatic starters, combination starters, and special refrigeration control units. These open and closed views show an Allen-Bradley special refrigeration control unit consisting of an A-B Bulletin 709 solenoid starter, Bulletin 836 high pressure cutout, Bulletin 837 thermostat with adjustable knob, and a Bulletin 600 manual starting switch.

## ALLEN-BRADLEY SOLENOID MOTOR CONTROLS

*for this season's installations*

COAL—GAS—OIL

# NATIONAL CAST IRON HEAT EXTRACTORS AND *Art* RADIATORS



NATIONAL *Art* RADIATORS

Slim, graceful, vertical lines and compact construction for easy recessing and attractive appearance . . . modern, efficient and artistic in any home.

National Heat Extractor boilers come in sizes ranging in Net I-B-R Ratings from 170 to 10,300 sq. ft. of steam and from 270 to 16,480 sq. ft. of water for hand or automatic firing.

Enduring cast iron National Heat Extractor Boilers and Art Radiators assure a complete, modern and versatile hot water or steam heating plant engineered for healthful comfort and fuel economy. A National Heat Extractor may be installed as a hand fired unit where necessary, and converted later to fully automatic firing of any type of fuel that conditions make most easily available. National Heat Extractors come in a full range of sizes and capacities to meet the heating needs of the smallest home to the largest building.

## IMPORTANT TO HEATING CONTRACTORS

Cast Iron National Heat Extractors and Art Radiators are readily available and provide good, profitable business especially under present conditions. The National family of heating products has long been a leader in customer acceptance. Write today for detailed literature on the "100", "200", "300", "400" or "500" series of National Heat Extractors and on Art Radiators and other National heating products.

**EXCLUSIVE**

## *NATIONAL HEAT EXTRACTOR* ADVANTAGES

- **Big Boiler Performance**—providing trouble-free efficiency and long life.
- **Economical Operation**—due to generous fire box proportions and fuel saving principle of extended heating surfaces with multiple flue section construction.
- **Compact Design**—assures top performance without bulkiness. Requires little space for installation and operation as compared with other boilers of equal capacity.
- **Easy Convertibility**—if hand fired unit is installed, convertibility to fully automatic gas or oil firing is simple.
- **Smart Appearance**—crinkle finish jacket in flamered and black harmonizes with color schemes in basements and utility rooms.
- **Tankless Heater and Storage Tank**—National Heat Extractors may be equipped with Tankless Heater or Storage Tank for year 'round supply of domestic hot water.

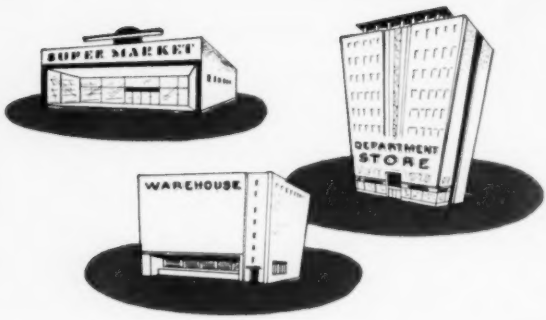
NRC

THE NATIONAL RADIATOR COMPANY

JOHNSTOWN, PENNSYLVANIA

**BRUNNER** SINCE 1906 **REFRIGERATION** helps you serve better

# Don't let the size of the job stop you!




Take on Brunner! Take on new business! With Brunner you have a line that sells—something to work with.

√ 40 sizes and types of refrigeration condensing units ranging from close-coupled air-cooled 1/4 hp units to husky 75 hp units for the big commercial jobs.

√ Specify and install with absolute confidence. Brunner's are completely Brunner built . . . known and accepted in every trade and industry as the soundest constructed units money can buy.

√ Dependable supply in any size, type or quantity. Brunner facilities have more than *doubled since the war* and still building.

√ Co-operation...both sales and engineering... is yours from a nationwide field organization staffed by men with years of practical, on-the-job experience. These men know your problems and talk your language.

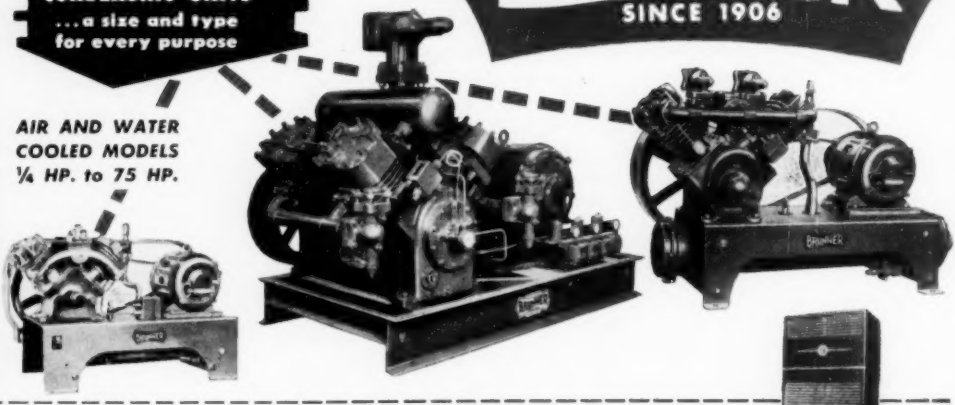
**BRUNNER MANUFACTURING CO.**
Utica 1, N. Y., U. S. A.

**PROFIT MARGINS,** markets and technical details are best covered in meeting with a Brunner factory representative. Spend a little time with him. See what Brunner can contribute to your better business. When do you want to see him?

**REFRIGERATION CONDENSING UNITS**
...a size and type for every purpose

**BRUNNER** SINCE 1906

*AIR AND WATER COOLED MODELS ¼ HP. to 75 HP.*



**BRUNNER** SINCE 1906

**AIR CONDITIONING**
Self Contained Units in 4 sizes: 3 - 5 - 7½ and 10 HP.
Remote Installation Types from 5 to 75 HP.

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**In Kansas City, Mo.,** as in other cities, American Blower Air Handling Products serve commerce, industry and public utilities. For air handling data in the Kansas City area, call American Blower—Victor 7181. Elsewhere, consult your phone book.

**Look before** you buy. There's a big difference in quality, design, quietness, operating costs and efficiency between American Blower and other air handling equipment. Comparison tests prove the superiority of American Blower products.

# Air is free . . . use it profitably!

To buyers of air handling equipment:

When you buy American Blower Air Handling Products you get equipment which is built by a reputable manufacturer with a background of 69 years' experience —equipment which is tested in accordance with the Standard Test Code and carries Certified Ratings.

In addition, whether the product costs $43.75 (price of a small ventilating fan) or runs into thousands of dollars (power plant equipment), you get the benefits of American Blower's broad scale research and uniform high quality.

To contractors:

When you recommend and install American Blower products, you build soundly for the future, save time and trouble, and make *more money* in the long run.

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Division of American Radiator & Standard Sanitary Corporation

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**AMERICAN BLOWER**

AIR HANDLING EQUIPMENT

*Serving home and industry*

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# Why contend with BLOW

## The Main Source of Air Conditioning Complaints?

**THESE EXCLUSIVE MULTI-VENT ADVANTAGES RESULT FROM THE ABSENCE OF BLOW:**

- Complete absence of draft velocities.
- Unparalleled uniformity and control of air temperature and air motion.
- Elimination of all air direction adjustments by diffusing vanes or baffles.

# *Specify* MULTI-VENT (T. M. REG.)

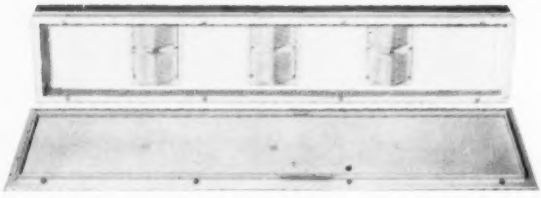
## *Low Velocity Air Diffusion CEILING PANELS*

Through perforated ceiling areas, Multi-Vent provides perfect overall air distribution entirely by pressure displacement—completely free from BLOW or high velocity injection. BLOW is the direct source of all draft hazards and is responsible for the most serious installation, balancing, maintenance and adjustment problems.

- No restrictions on the location of diffuser, regardless of walls and columns.
- Partitions may be moved at will, even to bisect a panel.
- More room air changes per hour, when required, with less air motion.
- Elimination of dirt impingement on ceiling and wall surfaces.
- Higher Diffusion Temperature Differentials with lower ceilings.
- No change in air diffusion pattern or cold drop when volume of air delivered is varied.
- Complete absence of the sound of rushing air.
- Complete concealment behind standard perforated acoustical ceiling pans.

*New* **THE MODULAR ONE-FOOT MULTI-VENT PANELS . . .**

**Available in 2, 3, 4, 5, and 6-foot lengths, supplementing the line of two-foot and three-foot wide panels.**



MULTI-VENT PANEL WITH PERFORATED DISTRIBUTION PLATE LOWERED (Standard metal acoustical pans may be substituted for the distribution plate)

**For comparatively small air volume requirements in new modular construction.**

**For long narrow peripheral zoning.**

**For economical installation in standard suspended ceilings.**

**For beautiful ceiling design with parallel strips of one-foot flush troffer lighting.**

*See SWEET'S Arch. & Eng. Files or: Write for detailed literature and the name of the Multi-Vent sales engineer in your vicinity.*

● *MULTI-VENT DIVISION*
**THE PYLE-NATIONAL COMPANY**
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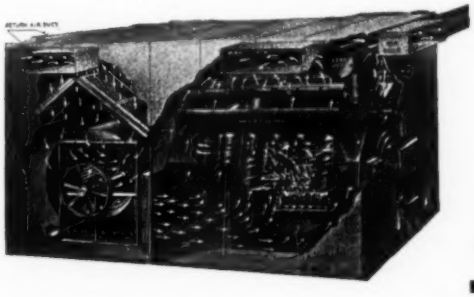
# LOW COST Warm Air Heating *for* Churches

Lutheran Church, Gowrie, Iowa. Architects, Henry C. Ecklund & Co., Thief River Falls, Minn. Campbell Heated since 1930.

Campbell Heaters meet every requirement for church heating. They provide fast heat delivery; positive control of temperature, humidity and ventilation; quiet operation, and outstanding fuel economy. They are also easily adaptable for summer air conditioning. Available for all fuels in capacities up to 2,160,000 B. T. U.'s



**For Drying & Processing Operations, we also build direct oil and gas-fired heaters up to 14,000,000 B.T.U.'s.**

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***Every Campbell Heater Backed by 65 Years' Heating Experience***

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**Simplify and Improve Design**
•
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•
**Reduce the Cost**

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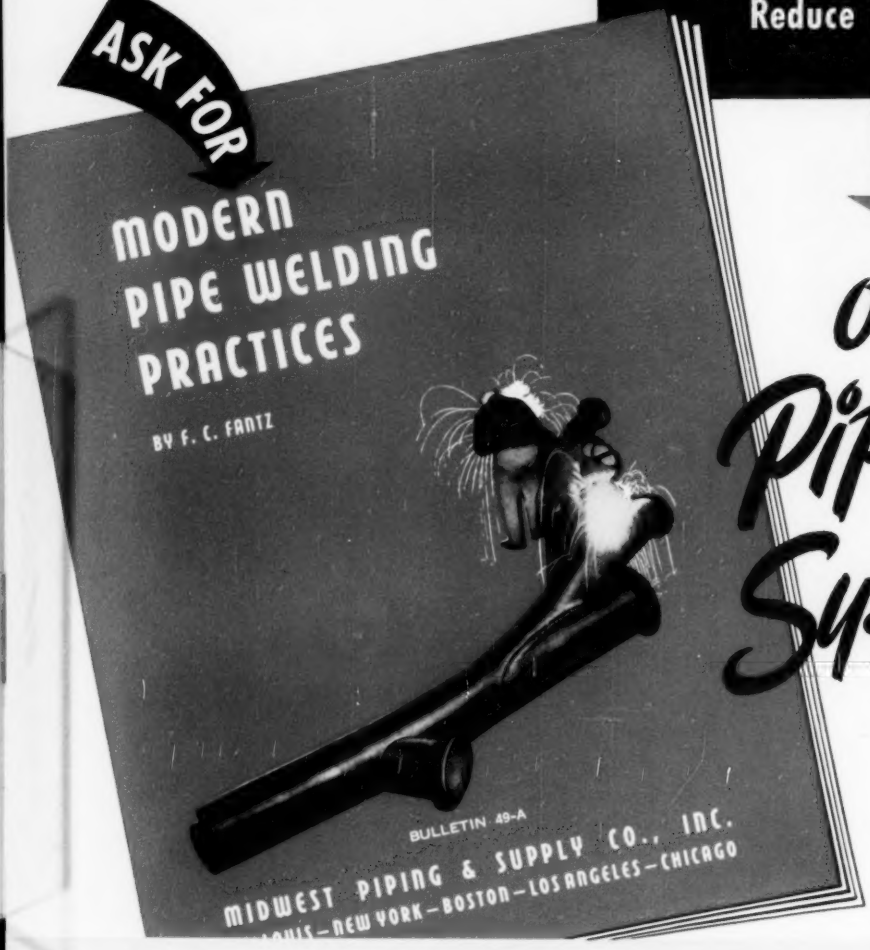


## of Piping Systems

**This technical bulletin is a study of ways and means of using welding for the improvement of piping systems. It was written by F. C. Fantz, Vice President, Midwest Piping and Supply Co., Inc., out of many years' experience with welding as applied to all kinds of piping. He has described in detail and illustrated a number of practical, tested methods of obtaining better piping assemblies. Here is a 16-page bulletin full of workable, proven ideas that will be helpful to anyone interested in modern piping systems. Use the coupon below or ask the nearest Midwest plant or office for a copy.**

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Please send me (without obligation) Bulletin 49-A, "Modern Pipe Welding Practices."

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Write for Bulletin A3-50. For information on stainless and alloy steel fittings ask for Bulletin S-1.

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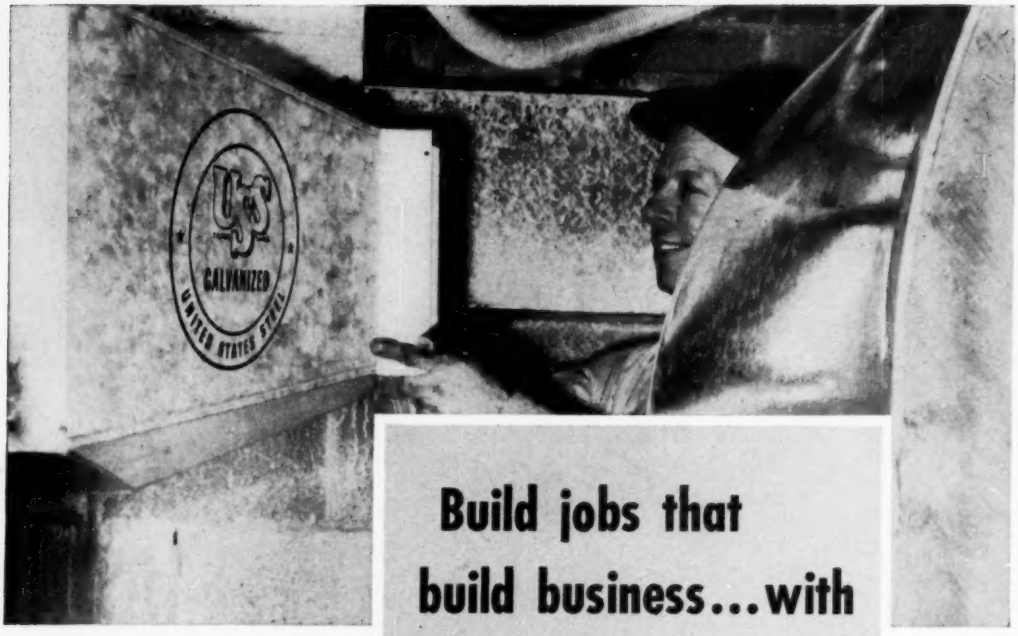


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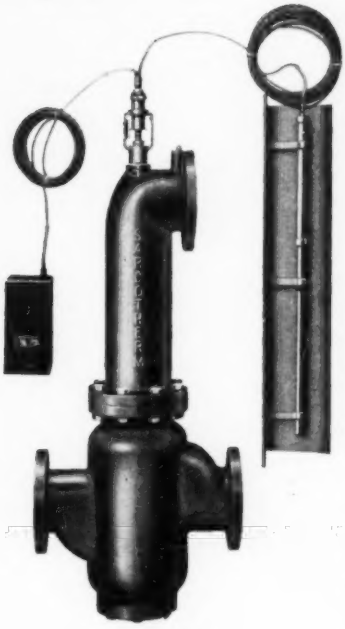
## THE IMPROVED MODULATING CONTROL for Hot Water and Radiant HEATING SYSTEMS . . . .

## *a good product made better*



Sarcotherm engineers are constantly searching for a better product.

While utmost simplicity is still the dominant design principle, the new models now available show many important improvements and refinements.

*Double Seated Valves* are now used in the larger sizes, greatly increasing valve capacity and permitting smaller valves being used on a given size job. *Convenient manual adjustment* features are now provided in a variety of combinations. *Program control systems* are available to meet any specification.

*Easy Installation.* New body construction simplifies piping and allows for easy servicing.

Hundreds of successful installations testify to the efficiency of this simple system. Our Engineering Department will be glad to recommend a suitable control system for your particular job.

*Ask for new Bulletin ST-501 describing latest improvements.*

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**Sarcotherm**

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# YOU CAN IMPROVE THE PERFORMANCE OF YOUR PRODUCT

## Choose this Wagner Two-in-One Motor

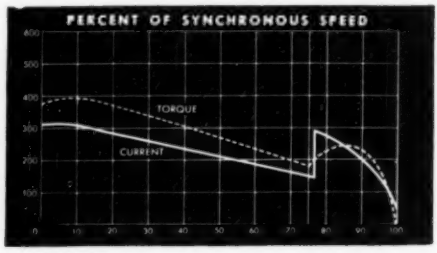
The selection of the *right* motor to power your product is all important. Troublefree operation, dependable long life performance, the ability of the motor manufacturer to provide on-the-spot service when needed, and the reputation of the manufacturer are all factors that build *real* customer satisfaction.

The versatile Wagner Type RA repulsion-start induction motor is not only the *best* choice for practically every type of motor-driven appliance and machine utilizing single-phase current, but is practically the *only* choice for a wide variety of applications because of its low upkeep cost, minimum servicing, freedom from vibration and noise, and years of reliable service.

More than 450 Wagner Authorized Service Branches and Parts Distributors *plus* 25 Wagner-owned Service Branches provide on-the-spot service, genuine repair parts, or replacement motors.

The graph at right shows the performance curves of the Wagner Type RA Motor. The motor starts as a repulsion motor with high torque but low current and switches to an induction motor while approaching rated speed to assure a constant high operating speed, even under overload, and a flat efficiency curve over a wide operating range.

The Wagner single-phase repulsion-start induction motor is widely known as industry's "general purpose" motor because it combines the best features of two types of motors: the repulsion motor during the starting period, and the induction motor while running at rated operating speeds. Pioneered by Wagner more than half a century ago, the Wagner Type RA offers the most simplified, troublefree design available, and is still the standard by which all other single-phase motors are judged.

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Wagner Electric Corporation
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AUTOMOTIVE BRAKE SYSTEMS – AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

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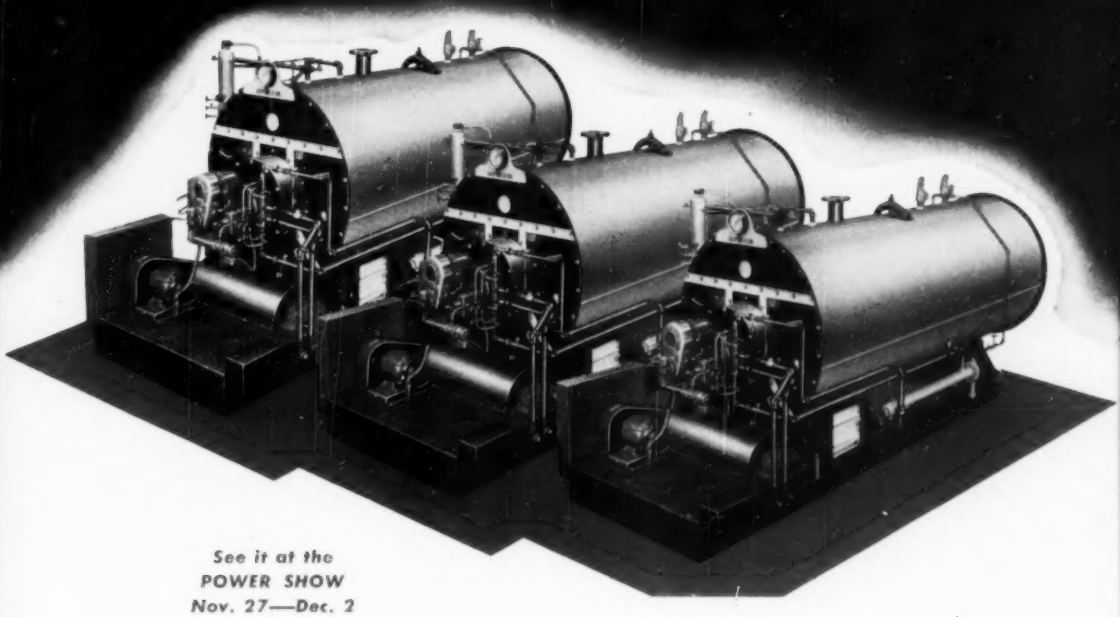
# 1+1+1=7

## WHEN YOU'RE COUNTING

# Superior STEAM GENERATORS



*See it at the*
**POWER SHOW**
*Nov. 27—Dec. 2*

*Battery installations of Superior Steam Generators provide extreme flexibility to meet the most widely fluctuating steam demands. A hospital installation illustrates the point.*

*From early June through September, steam demand is limited to the needs of hot water and sterilization. Any one of the three units carries this load with ease . . . and at higher efficiency than could be obtained by minimum operation of a larger boiler.*

*When cold weather adds its heating load, a second Superior Steam Generator is fired. Only the most severe weather demands firing the third unit . . . which throughout the rest of the year provides stand-by equipment which is desirable in any operation.*

*By employing different combinations of the three, (7 in all) allowing each unit in turn to share the load; all enjoy longer life at maximum efficiency . . . and by using only the number dictated by the steam demand, maximum economy at every stage of steam demand is assured.*

*Let us show you how battery installation can serve you better in your new plant . . . or augment your present steam facilities.*

*Write today for Catalog* 204

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## That engineered Air of Distinction

Greater efficiency, whisper-quiet operation, increased range of sizes, and sparkling new construction highlight the complete new line of Trane centrifugal fans.

A quarter century of fan engineering has enabled Trane to reduce horsepower requirements on its centrifugal fans to a new economical low. Carefully contoured inlets and generously sized outlets assure greater efficiency and lower outlet velocity at all operating levels.

To insure quiet, vibration-free operation every Trane Fan has dynamically balanced fan wheels revolving on precision finished heavy duty shafts.

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Wheel diameters range from 4½" to 109" and capacities from 115 cfm to 492,000 cfm in both belt and direct drive. This permits selection of exactly the right fan to meet your air handling problems.

All Trane fan ratings are certified in accordance with the standard test code approved jointly by NAFM and ASHVE.

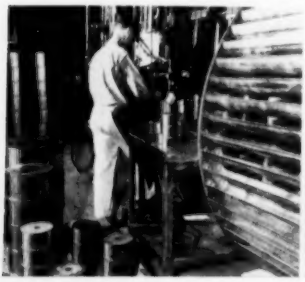
For complete information on Trane Centrifugal Fans write to the main offices or see the Trane representative in your area.

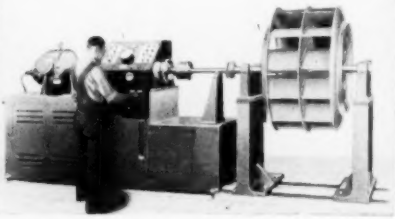
**THE TRANE COMPANY...LA CROSSE, WIS.**

EASTERN MANUFACTURING DIVISION, SCRANTON, PA.

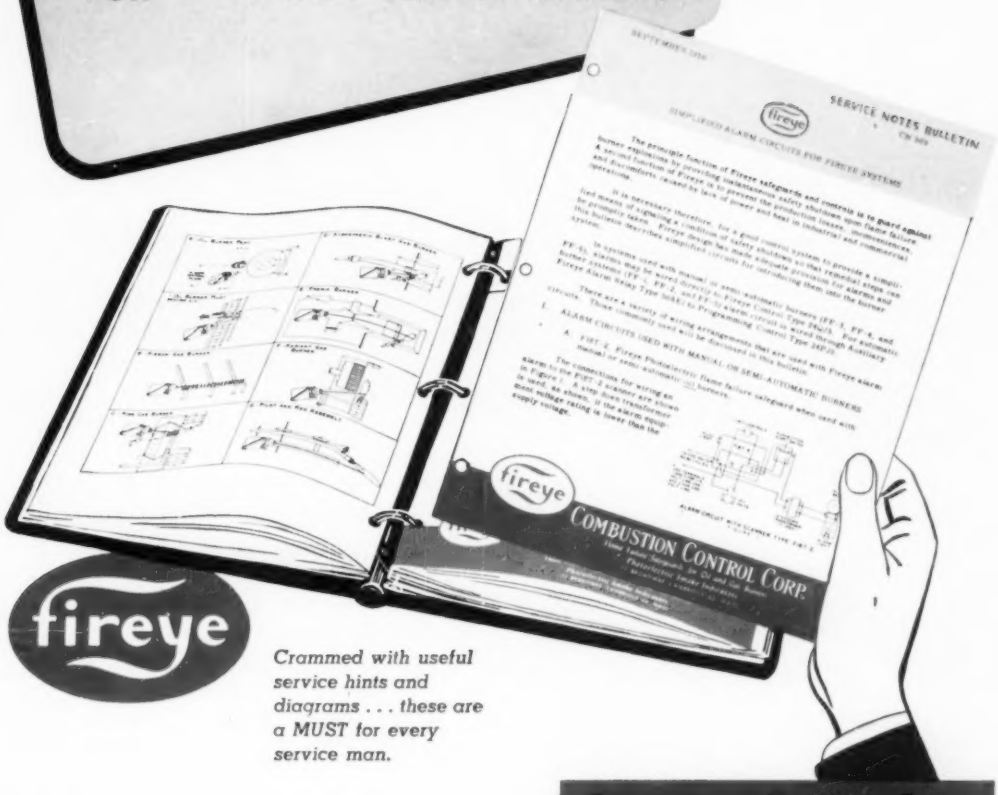
Manufacturing Engineers of Heating, Ventilating and Air Conditioning Equipment – Unit Heaters, Convector-radiators, Heating and Cooling Coils, Fans, Compressors, Air Conditioners, Unit Ventilators, Special Heat Exchange Equipment, Steam and Hot Water Heating Specialties ... IN CANADA, TRANE COMPANY OF CANADA, LTD., TORONTO.

Modern methods, precision tools and Trane engineering skill assure that close manufacturing tolerances are rigidly maintained.





# More NEW SERVICE HINTS FOR YOUR SERVICE MANUAL




fireye

*Crammed with useful service hints and diagrams . . . these are a MUST for every service man.*

. . . Mail the coupon for your copies today, because . . . with Fireye sales up more than 400% over last year's spectacular record . . . you'll be installing more and more Fireye equipment every day from now on.

There's a reason for Fireye's unprecedented popularity: it's the most positive and foolproof flame-failure protection . . . and that's why it sells itself to engineers who specify, install and service oil and gas burners for modern industry.

Mail that coupon NOW.

**COMBUSTION CONTROL CORP.**
77 BROADWAY, CAMBRIDGE 42, MASS.

Please send the following service bulletins:

- ☐ Hints on Flame Rods
- ☐ Simplified Control for Combination Gas/Oil Burners.
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- ☐ The Complete Fireye Story

NAME _____ TITLE _____

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STREET _____

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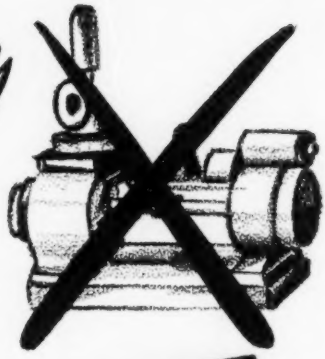
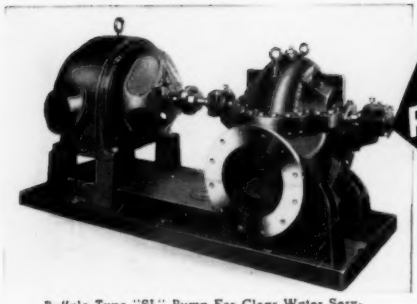
# Yesterday's Pumps Doing Today's Job?





Buffalo Type "SL" Pump For Clear Water Service. 10 to 10,000 gpm Capacities. Write for Bulletin 955-N.

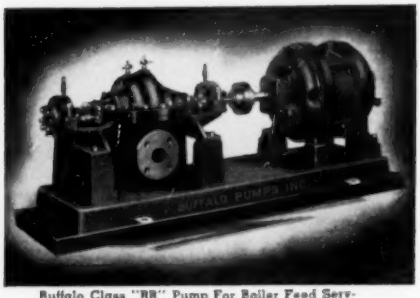
**REPLACE with "Buffalo" PUMPS**

- **YOU'LL SAVE IN MAINTENANCE**
- **YOU'LL SAVE IN POWER CONSUMPTION**
- **YOU'LL REDUCE PROCESS TIMEOUTS**

Yes — if you are doing a present-day capacity job in your plant, but doing it on pumps that have long been obsolete — it's a money-saving proposition to replace with modern "Buffalo" Pumps!

You'll find that, where those old pumps were continually on the "repair list", and were hogging power, your "Buffalo" Pumps will use little power for the work done — and require practically no attention over many years.

And there's a "Buffalo" Pump for best work on every special job — clear water or chemical. WRITE US YOUR PROBLEM — for the best replacement you can make.



Buffalo Class "BB" Pump For Boiler Feed Service. Write For Bulletin 980-B.

**BUFFALO PUMPS INC.**

171 MORTIMER ST. BUFFALO, NEW YORK

Canada Pumps, Ltd., Kitchener, Ont.

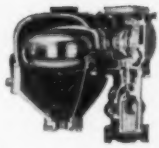
Branch Offices in all Principal Cities

**A BETTER CENTRIFUGAL PUMP FOR EVERY LIQUID**

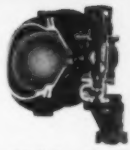
**No. 47 Boiler Water Feeder** — for hand-fired steam heating boilers up to 5000 sq. ft.

**No. 47-2 Feeder - Cut - off Combination** for automatically fired steam heating boilers up to 5000 sq. ft.

**No. 147 Boiler Water Feeder** — Similar to No. 47, but with higher feeding level for process steam boilers.



**No. 247** — Same as No. 47, but for installation with 1" equalizing pipes.



**No. 53-2 Feeder Cut-off Combination** — Similar to No. 51-2, but built for higher pressure, up to 75 lbs..

**No. 51 Boiler Water Feeder** — for hand fired steam heating boilers over 5000 sq. ft.

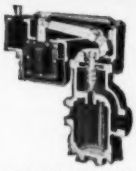
**No. 51-2 Feeder - Cut - off Combination** — for automatically fired steam heating boilers over 5000 sq. ft.

**No. 67 Low Water Fuel Cut-off** — for low pressure steam boilers of any size.

**No. 150 High Pressure Pump Control, Cut-off and Alarm** — for steam boilers of any size up to 150 lbs. pressure.

**No. 157 Water Column Type High Pressure Pump Control, Cut-off and Alarm** — for steam boilers of any size up to 150 lbs. pressure.

# You should know ALL of these McDONNELL PRODUCTS



**No. 101 Electric Water Feeder** — operated by No. 67 or liquid level switches.

• You are probably familiar with the more commonly used McDonnell Products. But for those jobs you may run across from time to time that call for special equipment, you should be familiar with *all* the McDonnell liquid level controls, flow switches, and similar products listed here. They are all evidence of how intensively McDonnell has worked at "DOING ONE THING WELL." We will be glad to give you information and counsel on any special application that may arise.

**McDONNELL & MILLER, INC., 3500 N. Spaulding Ave., Chicago 18, Ill.**

*Doing One Thing Well*

**No. 33 Safety Relief Valve** — for hot water heating boilers. Btu. rated. ASME standard.

**No. E-2 Flow Switch** — Completes (or breaks) circuit when flow starts or stops.

No. 21

No. 121

No. 321

No. 421

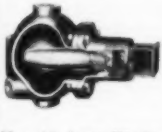
**Make-up Water Feeders**—to maintain adequate water supply in receiving tanks. Nos. 21, 121 and 321 are installed right in tank openings; available in various flange forms and sizes as shown to fit existing openings. No. 421 is for external application, with equalizing piping.

**No. L-8 Constant Level Valve** — Maintains constant fuel oil pressure on burner.

**No. 417 Snap Action Water Valve** — Maintains water level in humidifier pans and in tanks.

**No. 517 Water Level Control** — Same as No. 417, but in die cast float chamber with cover.

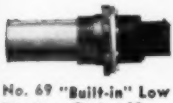
**No. 355 Large Capacity Float Valve** — Has many uses on tanks, stills, receivers, etc.



**No. 61 Low Water Fuel Cut-Off** — for 1" equalizing pipe installation on low pressure steam boilers.

**No. 63 Low Water Fuel Cut-off** — for water or steam boilers up to 50 lbs. pressure.

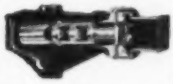
**No. 65 Explosion-proof Electric Controller** — Underwriters' approved for hazardous locations.



**No. 69 "Built-in" Low Water Cut-off** — Typical of many "built-ins" for installation in tappings provided in modern boilers.

**No. 469 "Built-in" Low Water Cut-off**— Similar to No. 69, but with less projection into boiler.

**No. 767 Low Water Fuel Cut-off** — (with No. 14 blow-off) for easy installation into opening in boiler.



**No. 80 Switch** — Three wire high- or low-level alarm or pump control on oil storage tanks.

**No. 6667 Conversion Head** — for converting former cut-offs into two-switch types.

**No. 154 High Pressure Pump Control** — Similar to No. 150, but with open contact switches.

# "HOTTER, SOONER" Saves YOU MONEY

Yarway Impulse Steam Trap with new stainless steel body.

Yarway Impulse Steam Traps get equipment hot and into production *faster.* Extra profits!

Then they keep it *continuously* at peak operating temperatures for maximum production. More extra profits!

What's the reason for *hotter, sooner?* Just this. When steam is turned on, Yarways open wide, discharging the air and condensate *in a hurry* —closing only when steam arrives. Then, when operating temperature has been quickly reached, the little valve (only moving part) literally *floats on the load* . . . discharging heat-retarding condensate as soon as it forms instead of waiting for quantities to accumulate. Thus equipment is held at peak operating efficiency.

Other economical features of Yarway traps—minimum maintenance, easy installation, low initial cost.

More than 600,000 Yarways have already been installed. Sold by distributors throughout the world.

Try a Yarway today . . . standardize on Yarways tomorrow.

**YARNALL-WARING COMPANY**
**107 MERMAID AVENUE, PHILA. 18, PA.**

Nest of Yarway traps installed with Yarway Strainers on cloth dryer. Note small space required.

Stainless Steel Body

**YARWAY IMPULSE STEAM TRAP**

*Chicago's Promontory Apartments*
*USE*
**100,000 FEET OF COPPER TUBE RADIANT HEATING**

CHASE

*The installation shown above is Chicago's new Promontory Apartments. It is heated by 100,000 feet of ⅜" Copper Water Tube.* Architects: *Ludwig Mies van der Rohe, Pace Associates.* Consulting Architects: *Holsman, Holsman, Klekamp & Taylor.* General Contractor: *Peter Hamlin Construction Co.* Heating Contractor: *Plonsker Engineering Co.* Builder: *Herbert Greenwald.* All of Chicago, Illinois.

For a spectacular, 22-story apartment building, a 6-room dreamhouse, or anything in between – architects and builders are using radiant heating—with Chase Copper Water Tube.

Chase Copper Water Tube in soft temper bends easily without special tools. In 60 and 100 foot coiled lengths, it needs a minimum number of connections—the few needed joints are quickly and simply made with solder-joint fittings.

You'll find it perfect for ceiling installations or concrete slab construction – because its light weight and small diameters are so easily handled. Long service life is assured, too, because Chase Copper Water Tube is so highly resistant to corrosion.

The next time *you* plan a radiant heating installation, remember that Chase Copper Water Tube means a better job, an economical job, a long-lasting job.

**FREE BOOKLET**
Mail the coupon for helpful radiant heating information.

Chase Brass & Copper Co., Dept. HPA-1150
Waterbury 20, Conn.

Gentlemen: Please send your "Suggestions for Designing Radiant Panel Heating with Copper Tube."

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*the Nation's Headquarters for*
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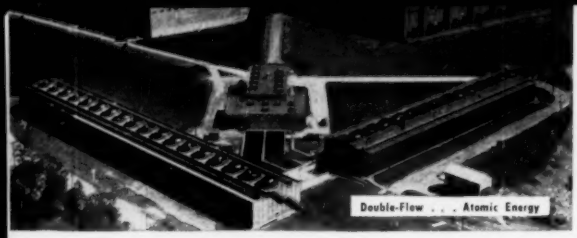
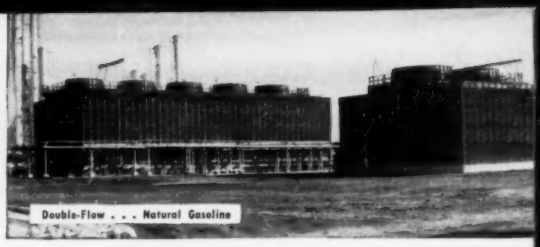
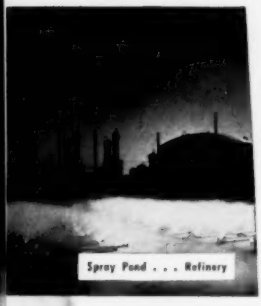
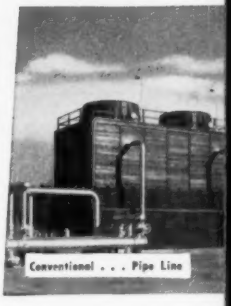

Double-Flow . . . Atomic Energy


Double-Flow . . . Natural Gasoline

# WHAT IS YOUR COOLING PROBLEM?


Spray Pond . . . Refinery

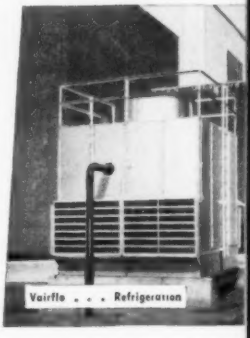

Conventional . . . Pipe Line

**IS IT COST?** Cooling towers or DriCoolers can have a low first cost with higher operating cost and vice versa. Or, you can get an economical combination of both. Marley application engineers have a complete line of units to select from and the "know-how" to help you make the best selection for your purpose.

**IS IT SPACE?** Marley equipment may be installed indoors or outdoors. Units are available with large base area and low height to give light loading per square foot or with small base area and greater height to fit in small area.

DriCooler . . . Diesel Cooling

**IS IT TEMPERATURE?** Usually, it is not economical to cool lower than a 5F approach to the wet bulb. However, in Marley cross-flow towers a quantity of water at wet bulb temperature may be obtained without added cost. For high level cooling, the DriCooler is applicable.


Vairflo . . . Refrigeration

**IS IT LOCATION?** Extreme temperatures, cold or hot, dust, wet bulb, altitude, brackish water, wind, storm conditions, or lack of proper water supply are problems that must be considered. Marley has a unit to fit any geographical condition.

**IS IT APPEARANCE?** Marley has a wide range of designs that will blend with any building architecture. Or even become a part of the building itself. Marley engineers can help your architect give you a good looking as well as efficient installation.

Double-Flow . . . Power

These are only a few of the problems you may face in the selection of a cooling tower or DriCooler. No matter what the problem, Marley Application Engineers have the answer to help you invest your dollars wisely and profitably.

DriCooler . . . Gas Cooling

MARLEY

Natural Draft . . . Air Conditioning

HP-11

**Write, Wire or Phone The Marley Company, Inc., Kansas City 15, Kansas.**

Name _____ Title _____

Company _____

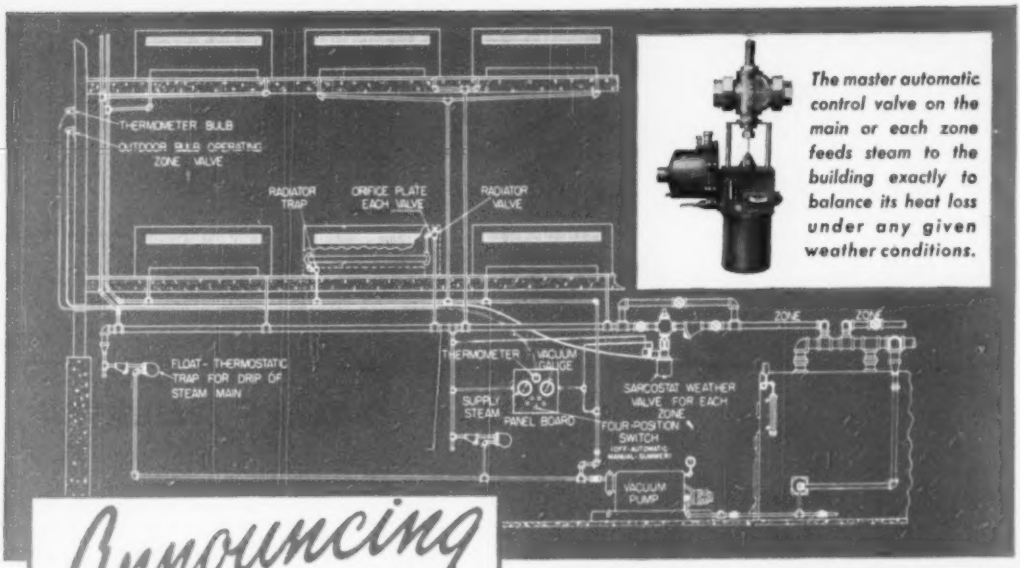
Address _____

City _____ Zone _____ State _____

☐ Please send "What's Your Cooling Tower IQ"

☐ Our Cooling Problem is _____

Aquatower . . . Air Conditioning






*The master automatic control valve on the main or each zone feeds steam to the building exactly to balance its heat loss under any given weather conditions.*

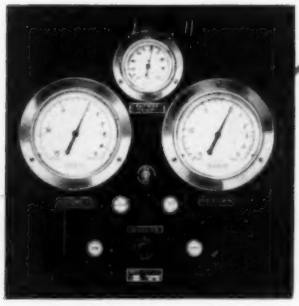
# *Announcing* Sarcostat

## WEATHER COMPENSATING CONTROL FOR STEAM HEATING SYSTEMS

**After intensive development work over a period of years, and on conclusion of field tests upon a number of pilot installations, we are ready to offer this radically new system of controlling heat supplied to buildings of all types, direct by outside temperature.**

**It is ideal for vacuum or vapor steam heating systems as now used in apartments, housing projects, hotels, and commercial and industrial buildings.**

**It will save its moderate cost in a short time by assuring heating comfort without fuel waste.**



THIS CONTROL PANEL GIVES YOU...

1. **Complete flexibility of operation, including "automatic," "manual," "summer," and "off" switch positions.**
2. **Indicator lights for each position.**
3. **Built-in time clock for night set-back and early morning pick-up.**
4. **Temperature and pressure indicators as specified.**

ASK FOR BULLETIN No. 200 330

**SARCO SAVES STEAM**

**SARCO COMPANY, INC.**
*Represented in Principal Cities*
Empire State Building, New York 1, N. Y.
SARCO CANADA, LTD., TORONTO 5, ONTARIO

IMPROVES PRODUCT QUALITY AND OUTPUT

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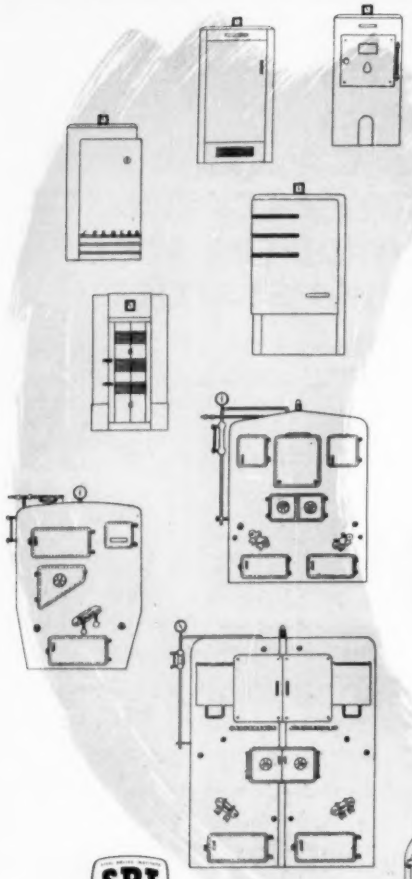
## THE QUALITY LINE OF

# HEATING BOILERS

**BACKED BY MORE THAN 60 YEARS' LEADERSHIP**



**VERSATILE:**

Boilers for all types of fuel, all methods of firing, all sizes of installations

**DEPENDABLE:**

Precision-engineered and manufactured to give superior, *guaranteed* service

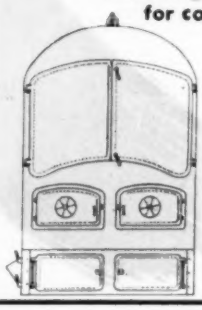
**THERE IS A**

# SPENCER

**FOR *EVERY* BUILDING . . .**

**FOR *EVERY* FUEL**

**Including 34 Steel Heating Boilers for commercial installations**



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Constructed in accordance with ASME requirements. Fully approved by Steel Boiler Institute or Institute of Boiler and Radiator Manufacturers.

SPENCER HEATER

LYCOMING-SPENCER DIVISION

WILLIAMSPORT AVCO PENNSYLVANIA

**Write for free catalogue today**

## *The Importance of the Revolving Discharge Outlet in the Heating of Industrial Buildings*

*by D. Gilbert*

The almost universal use of unit heaters for industrial plant heating indicates a conviction on the part of plant engineers, managers, consulting engineers and architects that this is the most satisfactory way of heating buildings and work rooms. Industry has come a long way, indeed, from the days not too long ago, when pipe coils, suspended from side walls or under windows, were the common means of heating a plant.

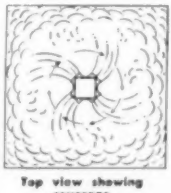
But, as pointed out in the article on Unit Heaters in a leading authoritative publication:

"In order to direct the air to points desired, and to diffuse the air to avoid drafts, unit heaters are commonly equipped with directional outlets, adjustable louvers, or fixed types of diffusers. . . . As hot blasts of air in the working zone are usually objectionable, heaters mounted on the floor should have their discharge outlets above the head line, and suspended heaters should be placed in such manner and turned in such direction that the heated air stream will not be objectionable in the working zone."

This is sound advice, but even with such stratagems, it is seldom possible to obtain satisfactory results. The basic difficulty lies in the use of *stationary* discharge outlets. Only one type of unit heater is able to avoid the objectionable "hot blasts" so distressing to workers in fixed positions, as on assembly lines or at machine tools. That is the heater suspended from roof or ceiling in which the downward discharge of heated air is distributed by slowly *revolving* discharge outlets. There are no fixed blasts, no chilly corners untouched by the air streams; just a gentle, thorough movement of the heated air at the working level, over obstacles, around obstructions, moving under tables, benches, truck bodies, airplane wings, even into repair pits. The result is an evenly warmed blanket of air at the working level, a gently moving, invigorating atmosphere that is pleasantly stimulating to the worker and better for his health.

**The Discharge Outlets REVOLVE —only with WING unit heaters**

Side view showing moving streams of heated air



Top view showing coverage

The distinguishing feature of the WING Revolving Unit Heater, which makes its performance so outstandingly superior to other heaters is the Revolving Discharge Outlet. These outlets, moving slowly through a complete circle flood the entire heating area with a blanket of fresh, live warm air. The gentle air motion caused by the constantly changing directions of the heated air from the revolving outlets creates a refreshing stimulating atmosphere beneficial to employee morale and productivity. Hot blasts and chilly areas are eliminated. Get complete information by writing today for Bulletin HR-5.

**L. J. Wing Mfg. Co.**

*Executive Offices and Factory:* 140 *Vreeland Mills Road, Linden, N. J.*

*Canadian Factory:*
*Montreal, Canada*

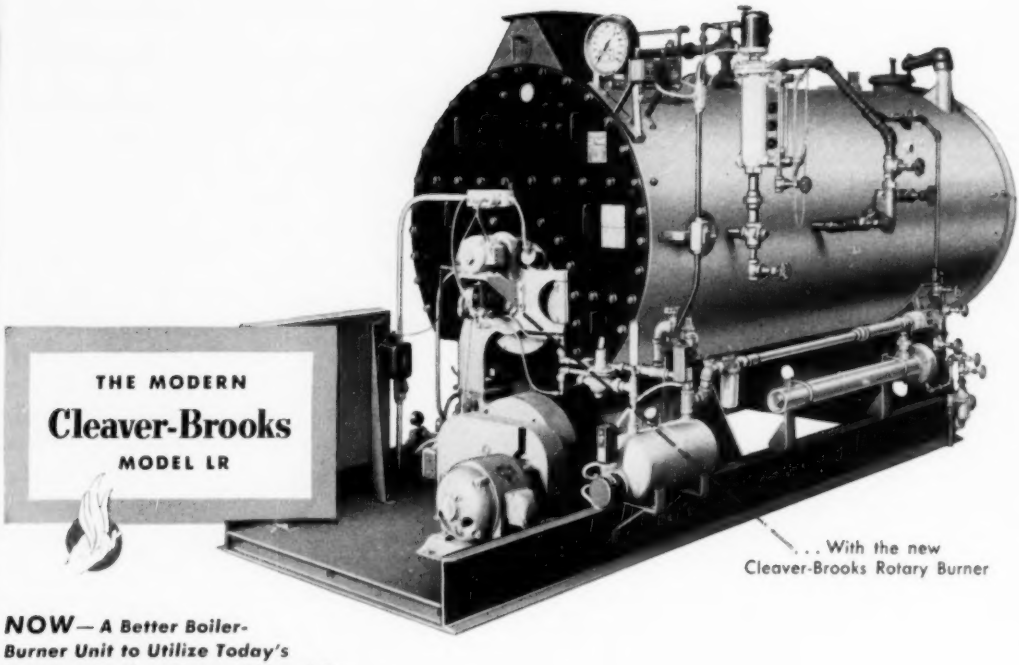
*In Europe:*
*ETABLISSEMENTS WANSON*
*Haren-Brussels, Belgium*

**Wing**

**Revolving UNIT HEATERS**

# Design

## FOR PRODUCING STEAM




***NOW*— *A Better Boiler-Burner Unit to Utilize Today's Low-Cost Fuels — Heavy Oil and Gas***

The Cleaver-Brooks Model LR is a "trail-blazer" in modern self-contained boiler design and construction. It makes more effective use of today's low-cost fuels, (heavy oils and gas), and you are assured of better boiler performance.

*A Brief List of Notable Features:*

— the new Cleaver-Brooks rotary burner — simple — compact — precision machined — perfect mechanical balance — fully automatic — provides unprecedented flexibility in burning heavy fuel oils or industrial gases.

— single low-speed, low-power consumption blower furnishes both primary and secondary air for combustion—less weight and space requirements — reduction in sound levels.

— totally enclosed, drip and dust-proof panel for all major electrical controls.

— electronic combustion safety devices, dual low water cutoffs — are standard equipment.

— simplified design of combination gas-oil burner permits change-over from oil to gas or vice versa in less than a minute.

— improved design of boiler furnace and liberal heating surfaces provide greatest economy with all fuels.

— boilers of all-welded construction — meet standards of A.S.M.E. boiler code and leading underwriters — burner approved by recognized national agencies.

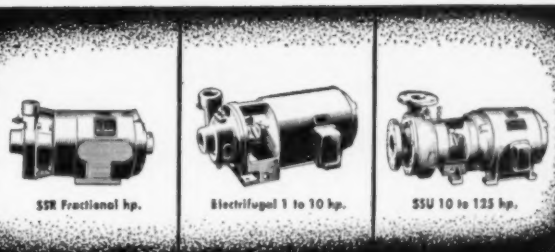
The Cleaver-Brooks Model LR self-contained boilers are of a highly developed four-pass fire tube design — tested and proved by factory and field experience on several thousand boilers of this type.

*Write for complete specifications, dimension data, firing rates.*

CLEAVER-BROOKS COMPANY
**367 EAST KEEFE AVENUE**
**MILWAUKEE 12, WISCONSIN**

**Now Ready:** Bulletin SC 142 contains detailed data and description of the MODEL LR. Send for your copy today!

ALLIS-CHALMERS
PACKAGE
PUMPS



NEW

# Air Conditioning Pumps

## LOW COST, QUIET, DEPENDABLE

HERE IS A PUMP SPECIFICALLY DESIGNED for air conditioning contractors and manufacturers of air conditioning equipment. It offers the high quality features for which Allis-Chalmers pumps have always been known at a competitive price. Easy to mount and connect, it operates very quietly and requires a minimum of service.

### Quality Features At Low Cost

The motor is a NEMA standard design. Pump and motor are rigidly connected by an adapter to form a single unit which requires only 4 bolts to mount.

A mechanical seal which requires no packing and no maintenance is used.

The discharge opening can be moved to any of four positions by simply changing the position of four bolts. The impeller can easily be removed with a screw driver and a hex head socket wrench.

### Free Engineering Help

Your nearby Allis-Chalmers representative will be glad to help you engineer your installation or equipment to assure you of good performance at low cost.

### Nation-wide Service

Nearly every industrial city has one or more Allis-Chalmers Certified Service Shops to provide you and your customer with factory approved parts and service. Sizes range to 80 gallons per minute with heads to 100 feet; open or closed impeller depending on size. Vertical mounting bracket available in many models.

*Send For* COMPLETE INFORMATION

ALLIS-CHALMERS, 1171A SO. 70 ST.
MILWAUKEE, WIS.

Please send me Bulletin *5287529* describing your air-conditioning pump.

Name .....

Company .....

Title .....

Address .....

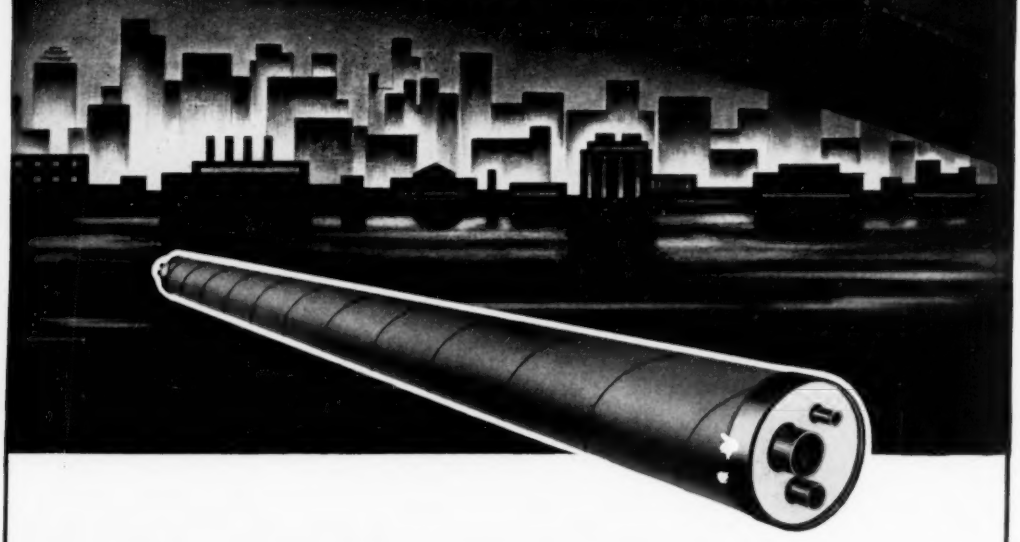
City ..... State .....

A-3182

A-C ALLIS-CHALMERS

# ALLIS-CHALMERS

# ENGINEERS PROFIT FROM Ric-wiL 40 YEARS PIPING EXPERIENCE...



## ...AS LEADER IN PREFABRICATED INSULATED PIPING SYSTEMS

Insulated piping, prefabricated of the finest known protective and insulating materials, accurately and carefully constructed for high operating performance and long trouble-free life—that's Ric-wiL Insulated Pipe.

Skilled Ric-wiL piping engineering and consulting service available to engineers and contractors for planning and design of flexible, high-efficiency insulated piping systems—that's part of Ric-wiL service.

Forty years devoted exclusively to design, research, and production of insulated piping systems—that's Ric-wiL experience.

Ric-wiL products, services, and experience bring to all engineers the most convenient and efficient answers to their insulated piping problems.

Your nearest Ric-wiL representative will be glad to give you detailed information as related to your specific problem.

40th YEAR DEPENDABLE INSULATED PIPING SYSTEMS 1910 - 1950

For full technical information on Ric-wiL Insulated Piping Systems, call or write the Ric-wiL office nearest you or Dept. 1-DA in Cleveland, Ohio.

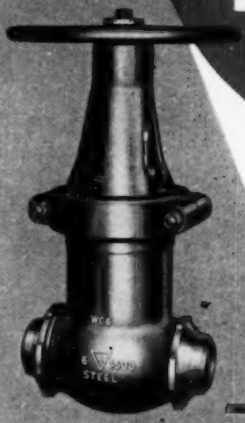
RIC-WIL
INSULATED PIPING SYSTEMS
THE RIC-WIL COMPANY · CLEVELAND, O.

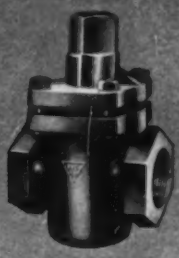
OVERHEAD UNDERGROUND

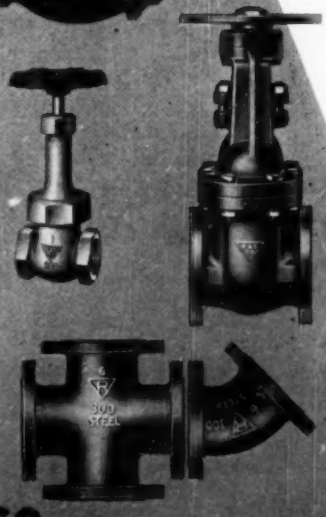
FOR FORTY YEARS THE GREATEST NAME IN INSULATED PIPING SYSTEMS

more and better service from

# R·P&C VALVES







## ...here's One Reason Why:

*Over 60 years ago, a PRATT & CADY Board of Directors passed this resolution:*

## Resolved:

"That the superintendent
"shall be held responsible
"for the production of goods
"as near perfect in design,
"material and workmanship
"as shall make them merchantable
"and of a character that will serve
"to establish for this company
"a high reputation."

• This policy has remained unshaken through two world wars. The "high reputation" has been maintained. More than ever before, the valves offered by R·P&C meet the demand for longer and better service.

ACCO

Reading, Pa. • Atlanta • Baltimore • Boston • Chicago • Denver • Detroit • Houston
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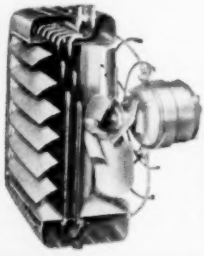
R-P & C VALVE DIVISION
AMERICAN CHAIN & CABLE

READING-PRATT & CADY VALVES

# It pays to get the whole picture when selecting Unit Heaters

## FOCUS ON STYLING

Here's beauty that works! One look at a Modine's sleek, simple lines — styled by one of America's top industrial designers—and you'll agree that Modines offer you the most in dynamic, functional appearance.



## FOCUS ON CONSTRUCTION

It's a fact! Modines stand up to the slugging of hard use . . . the wear and tear of time. Only corrosion-resistant copper and copper alloy are used for steam-carrying passages. Tubes and headers are cylindrical and brazed at the joints for greater pressure-resisting strength. Individual expansion bends absorb differential stresses. Casings are Parker-Bonderized for rust protection.

## FOCUS ON PERFORMANCE

Owners say they get finest performance with any Modine — *Horizontal*, *Vertical*, or *Power Throw* model. The reason is simple. Modines are skillfully engineered to give you the correct outlet air temperature and sufficient air velocity for uniform comfort . . . maximum fuel economy.

## You'll be shooting for savings when you select Modine

Yes, when you get *the whole picture*, you'll just naturally select Modine Unit Heaters. In factories, stores, hundreds of other locations—Modine Unit Heaters excel in efficient, low-cost service. Get all the facts from your nearest Modine representative. He's listed in the classified section of your phone book. Or write direct. Modine Mfg. Co., 1509 Dekoven Ave., Racine, Wis.

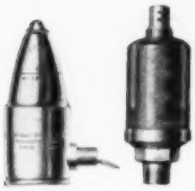
*ASK for Modine Unit Heater Bulletin 149A. Also available — bulletins covering special applications in commercial brooder houses, greenhouses, and milk houses.*

U-1071.

**Modine UNIT HEATERS**

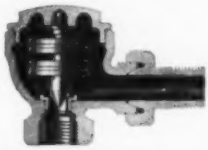
FOR FACTORIES • STORES • GREENHOUSES • COMMERCIAL BROODER HOUSES • MANY OTHER APPLICATIONS

VENT VALVES ✓

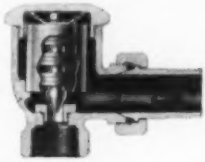


SUPPLY VALVES ✓

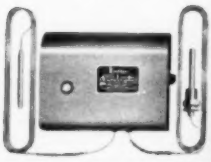
LOW PRESSURE RADIATOR TRAPS ✓



HIGH PRESSURE RADIATOR TRAPS ✓



CONTROLS FOR FORCED HOT WATER SYSTEMS ✓



# HOFFMAN

## HEATING EQUIPMENT

For either two-pipe or two-pipe steam, hot water, residential or industrial heating—Hoffman has designed and produced the correct valve or control for each specific requirement. And, each Hoffman product is distinguished by exclusive features that assure customer satisfaction, long, carefree service.

*It's the* COMPLETE *valve, quality line* backed by a dependable, single source of supply and responsibility. *Let Hoffman Products cost no more than the ordinary kind.* To avoid delays—order now, from your wholesaler of heating and plumbing supplies.

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INVERTED BUCKET TRAPS ✓

ZONE CONTROLS FOR STEAM AND HOT WATER ✓

F. & T. TRAPS ✓

HOT WATER VENT VALVE ✓

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TEMPERATURE REGULATORS ✓

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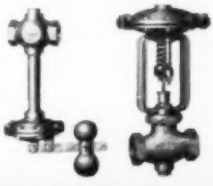
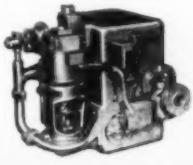
PRESSURE REDUCING VALVES ✓

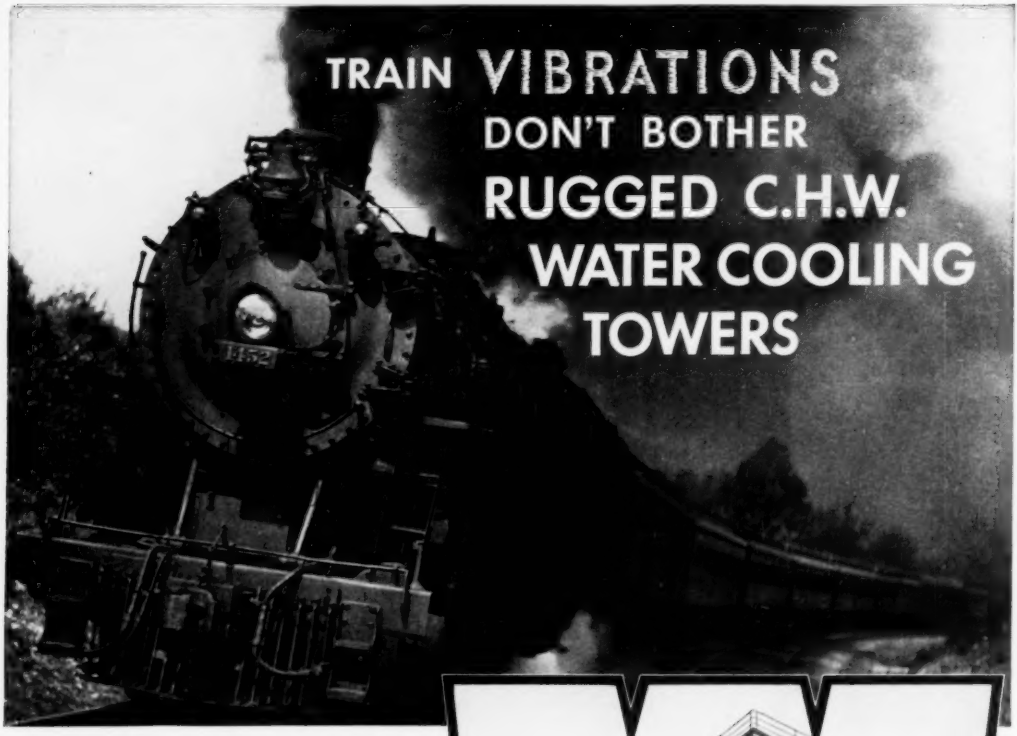


VACUUM AND CONDENSATION PUMPS ✓



"MR" CONDENSATION PUMP ✓

✓ A COMPLETE LINE of HEATING SPECIALTIES



# TRAIN VIBRATIONS DON'T BOTHER RUGGED C.H.W. WATER COOLING TOWERS

Speeding express trains and thundering freights can cause serious vibrations with damaging effects on equipment located nearby. Here's a C. H. W. water cooling tower installed so close to one of the country's heaviest traveled railroads that passing trains nearly knock your hat off. This tower of The Bayer Company, aspirin manufacturers at Trenton, N. J., is as good as the day it was built. And there are many good reasons why they haven't had any "headaches" with it. In a C. H. W. cooling tower you get a sturdy structure, assembled by experts, with redwood members rugged enough to withstand stresses, strains and vibrations (caused by trains or most anything else up to hurricane winds of 100 m. p. h.). Wood fill is of sufficient size and weight to "stay put" without the use of nails, and vertical members are securely bolted. A distorted distribution system or wood fill "out of place" affects the efficiency of the tower—hence the reason for C. H. W.'s "vibration proof," rugged construction. For other exclusive features of C. H. W. towers, write for literature.

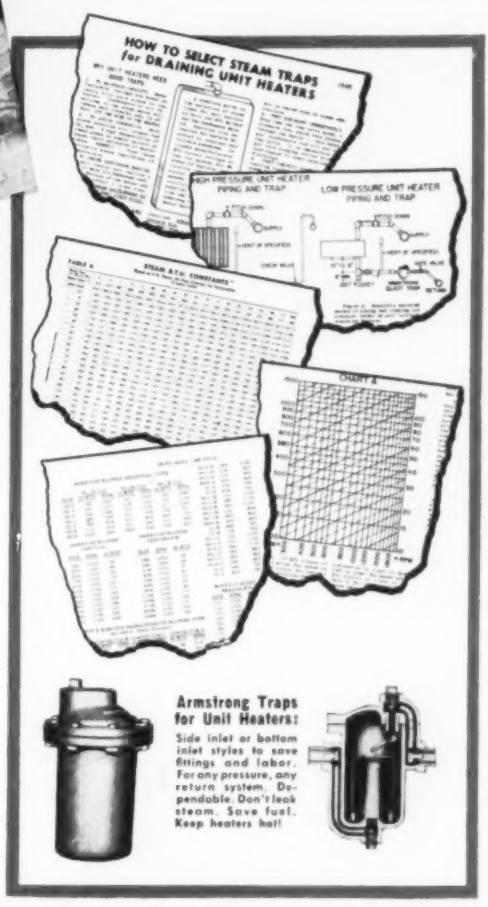
**C. H. WHEELER MANUFACTURING CO.**
**1826 Sedgley Avenue, Philadelphia 32, Pa.**
REPRESENTATIVES IN MOST PRINCIPAL CITIES

*C. H. Wheeler*
SINCE 1903

STEAM CONDENSERS · WATER COOLING TOWERS
EJECTORS · STEAM JET VACUUM REFRIGERATION
OF PHILADELPHIA

# HOW TO SELECT UNIT HEATER TRAPS

1. To obtain full BTU output
2. To insure continuous service
3. To avoid corrosion


HOW TO SELECT STEAM TRAPS for DRAINING UNIT HEATERS
HIGH PRESSURE UNIT HEATER PIPING AND TRAP
LOW PRESSURE UNIT HEATER PIPING AND TRAP
Armstrong Traps for Unit Heaters:
Side inlet or bottom inlet styles to save fittings and labor. For any pressure, any return system. Dependable. Don't leak steam. Save fuel. Keep heaters hot!

THE ANSWERS are in a new 8-page handbook prepared by Armstrong! Only thing of its kind, this manual explains why it is important to use dependable traps that are properly sized and that will discharge condensate and corrosive incondensable gases at steam temperature; tells how to select traps by the BTU Method and the Condensate Weight Method; includes tables of BTU outputs of the heaters produced by 24 different manufacturers; discusses heater manufacturers' recommendations on types of traps to use and methods of installation; and includes tables and charts for working trap selection problems.

Anyone is welcome to a copy of this helpful guide to better unit heater performance. Address your request to:

**ARMSTRONG MACHINE WORKS**

874 Maple St., Three Rivers, Michigan

**ARMSTRONG Inverted Bucket STEAM TRAPS**

*Over a Million in Use... For Power... Process... Heating*

# Insulation sensation

*New Carey "Super-Light"*
*PRECISION-SIZED*
*85% magnesia!*

**1** More heat-saving efficiency

**2** Extreme light weight slashes application, freight and handling costs

**3** Available in new "nesting 0.8" precision-sized pipe coverings — precision-fitted blocks, and efficient insulating cement form

**4** Large semi-cylindrical sections — through 18" pipe size

Carey "Super-Light" is 85% Magnesia in a new, improved, better-than-ever form. Made under a new scientific precision-sized "self-set" method, it combines light weight, chemical purity, dimensional stability, high compressive strength and low thermal conductivity — factors that assure superior performance, extra years of dependable service.

Carey "Super-Light" 85% Magnesia works wonders right from the start. Costs less to apply . . . performs miracles as a fuel-saver . . . increases plant efficiency.

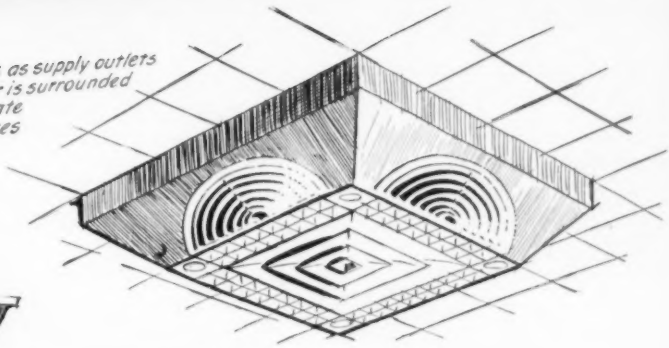
Wherever you are, whatever your insulating needs, you're on your way to new economies, new highs in efficiency with Carey "Super-Light" 85% Magnesia on your job. For more detailed information about this latest **insulation sensation,** write or phone your nearest Carey office, or—

**THE PHILIP CAREY MANUFACTURING COMPANY**
**Cincinnati 15, Ohio**

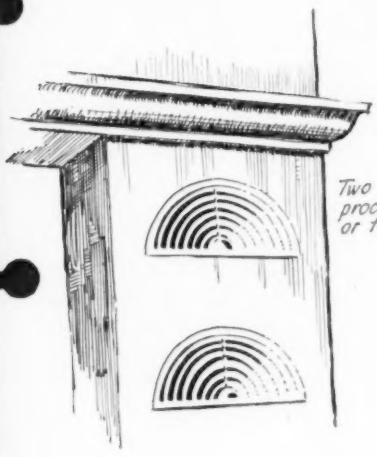
In Canada: The Philip Carey Company, Ltd.,
1557 MacKay Street, Montreal 25, P. Q.

**Carey.**

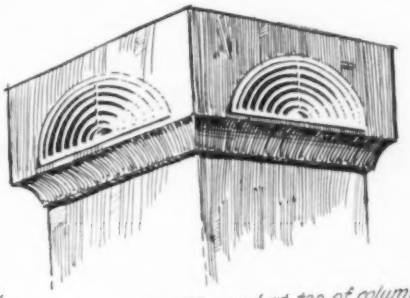
# ideas for using ANEMOSTAT AIR DIFFUSERS



Type W Anemostats as supply outlets
Type E for return air is surrounded
by narrow egg crate
fluorescent fixtures



Two Type W's at side of
procenium arch for auditorium
or theatre installation



Remember – pattern control can easily
be obtained with standard Anemostat
Air Diffusers

Type W's used at top of column
which conceals air duct

Anemostat Air Diffusers offer unlimited design possibilities. They can be used in regular, acoustical and egg crate ceilings . . . combined with all types of lighting fixtures . . . in commercial, industrial and home applications. Anemostat Air Diffusers provide uniform diffusion throughout the entire conditioned area. They eliminate harmful drafts, stale air pockets and equalize temperature and humidity. New Selection Manual contains complete application and specification data. Write for your copy.

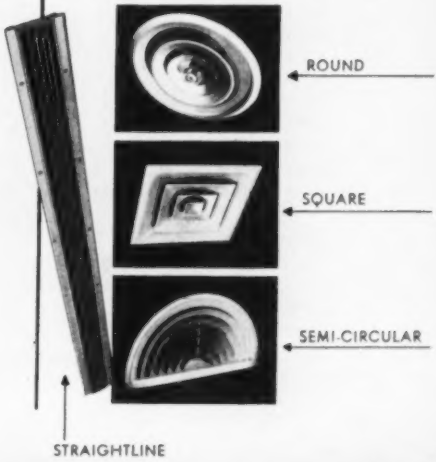
**"No air conditioning system is better than its air distribution"**

**ANEMOSTAT®**

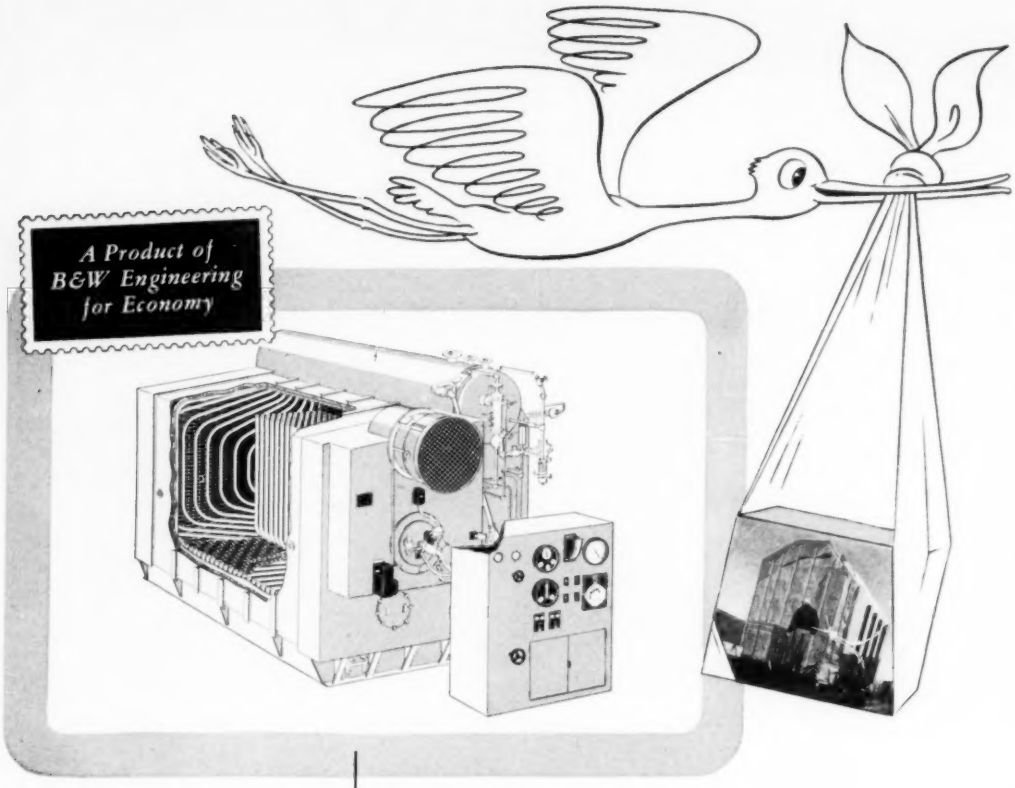
**DRAFTLESS *Aspirating* AIR DIFFUSERS**

ANEMOSTAT CORPORATION OF AMERICA, 10 EAST 39th STREET, NEW YORK 16, N. Y.
REPRESENTATIVES IN PRINCIPAL CITIES

**ANEMOSTAT** offers maximum design possibilities because only Anemostat Air Diffusers come in all these shapes




AC 1260




# NEW ARRIVAL IN LOW-COST STEAM

**Cost Saving Features of the New B&W Integral-Furnace Boiler, TYPE FM**

- Saves Erection Time and Cost
- Meets Wide Range of Services
- Handles Quick Load Changes
- Fast Steaming
- Low Maintenance
- Easy Accessibility
- Suitable for Outdoor Service
- Burns Oil and/or Gas
- Saves Fuel
- Saves Space
- Safe, Automatic Operation

*Helping Industry Cut Steam Costs Since 1867*

## SHOP ASSEMBLED . . . READY TO USE

Latest addition to a distinguished family is the new B&W Integral-Furnace Boiler, Type FM . . . developed from B&W's seventeen years' pioneering experience combining boiler and water-cooled furnace in a single, integrated unit.

Formerly available only in large industrial and central-station designs, Integral-Furnace Boilers have already accounted for over 100 million pounds per hour of new steam-generating capacity since their introduction in 1933. And now their proved advantages are incorporated in a completely shop-assembled, self-contained unit.

Small and medium size plants, institutional and commercial establishments will find in this unit all the answers to low-cost heating and process steam-generating requirements from 3,000 to 35,000 lb. per hr. at pressures to 250 psi. Large plants, too—where space and load characteristics warrant—may profitably consider several packaged boilers as against a "tailor-made" installation.

*Send for Bulletin G-72, detailing the many advantages of this new B&W creation in low-cost steam generation. The Babcock & Wilcox Company, 85 Liberty Street, New York 6, N. Y.*

BABCOCK & WILCOX

G-503

# THE EDITOR'S PAGES

• IN ADDITION to the Directory Section of heating, piping and air conditioning equipment for industrial, commercial, institutional and public buildings to appear in the January HPAC, this same issue will also feature a Show Section with complete details of the International Heating, Ventilating and Air Conditioning Exposition to be held in Philadelphia the latter part of that month. . . . These two "special attractions" supplement our regular editorial content, which includes, of course, the Journal Section of the American Society of Heating and Ventilating Engineers. . . . Some years ago, a well-known author (we've forgotten his name despite his fame) said that writing a book was like giving birth to a grand piano. It's the way we expect to feel ourselves after our big January number is off the press and into the mails.

## NEW ADDITION TO HPAC EDITOR'S BOARD

A NEW NAME appears this month on HPAC's board of consulting and contributing editors (page 5)—that of M. K. Fahnestock, research professor and coordinator of research, department of mechanical engineering, college of engineering, University of Illinois.

Widely known for his earlier work in steam and hot water heating and air conditioning, Professor Fahnestock in recent years has devoted a great deal of his time to the physical environment studies conducted at Urbana and in the colleges in Chicago, his principal professional interest being the physiological effect of atmospheric and environmental factors and the bringing together of the engineering and medical people to interpret and solve the problems. He has been particularly concerned with the development of the physical facilities and personnel for these important studies.

His most recent paper to appear in our pages was published in September, and was entitled The Physical Environment Unit at the University of Illinois.

## 1950 CONSTRUCTION AHEAD OF '49

CONSTRUCTION contract awards in the 37 states east of the Rockies in September declined from the all-time high figure set in August, but were still high enough to bring the first nine months of 1950 well ahead of the same period in 1949, according to F. W. Dodge Corp.

The September total of $1,286,541,000 was down 17 percent from August's record, but was 18 percent higher than September 1949. The nine month total of $11,109,746,000 was 50 percent higher than the comparable total for 1949.

The total of square feet of floor area for the first nine months of 1950 was 1,007,231,000, 63 percent higher than the same total for 1949.

Residential awards in September totaled $549,585,000, a decrease of 27 percent from the August figure, but an increase of 5 percent over September 1949. Non-residential awards totaled $198,725,000 in September, 8 percent less than the August figure, but 45 percent higher than September 1949.

Public and private works and utilities totaled $238,231,000, 6 percent lower than the August figure but 7 percent higher than September last year.

## "SMELL COLLECTORS" SOAK UP ODORS

NO DIRT OR smells from the new Washington, D.C., refuse transfer station can reach the Capitol or House and Senate Office Building,

ACTIVATED CARBON adsorbers at Washington's new refuse transfer station

but a short distance away, according to the W. B. Connor Engineering Corp. In passing the necessary legislation, Congress insisted that no dust or odors be allowed to escape from this central transshipment point for some 300,000 cu yd of refuse and garbage—that portion of the quantity collected annually which is delivered to this station.

All operations take place indoors, the municipal trucks driving up ramps and dumping their loads into waiting gondola cars and truck trailers. The surrounding air is sucked up by huge fans and thence drawn through dust cyclones and banks of spun glass filters. If odorous it is then put through "smell collectors"—hundreds of porous canisters containing activated carbon—which soak up odors much like a sponge soaks up water.

According to W. A. Xanten, superintendent of the division of sanitation, the significant feature of the plant is that of the total cost of $918,700, the dust and odor control equipment cost but $37,400, or 4 percent.

## MATERIALS SHORTAGES "NOT INEVITABLE"

SHORTAGES OF construction materials "will not inevitably exist" in 1951, it was forecast last month by Thomas S. Holden, president of F. W. Dodge Corp., in addressing the fall convention of the Central Supply Association at Chicago.

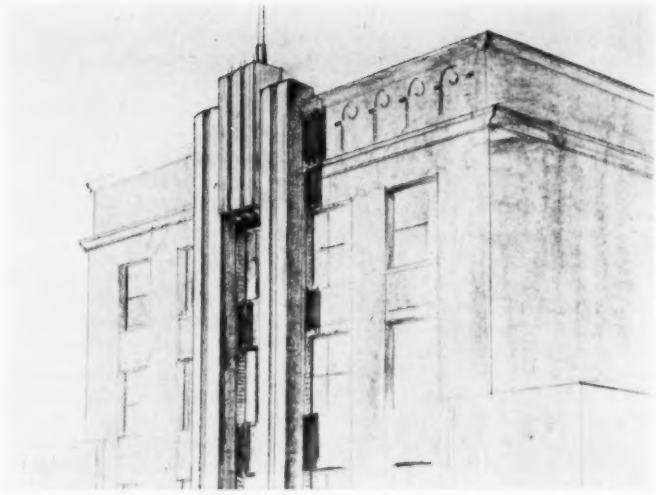
"It is not possible to point to any essential construction material and say that it will not be available next year for civilian uses in appreciable amounts," said Mr. Holden. "Metal products may tend toward tight supply. Non-metallic materials are apt

to be in quite adequate supply, to sell on a fully competitive basis."

Mr. Holden expressed the concept of the long-range rearmament program as "our full employment pump primer in place of the very uncertain housing and consumer goods boom the government was promoting for that purpose a year ago."

He predicted that the boom will be flattened out, but that there is every likelihood that a large and varied program of construction activity will go forward.

"During the past two months," the F. W. Dodge president said, "many producers and suppliers of construction materials have been oversold. Panic buying on top of the biggest housing boom in history created a very abnormal market situation which could not last. In fact the over-extended housing boom was fast moving toward a surplus situation," he said.



FACE-LIFTING of building incorporates chilled water risers for air conditioning on outside. Sketch shows how piping will be covered with stainless steel jacketing

## AIR CONDITIONING RISERS PART OF NEW FACADE

A DRAMATIC approach to modernization of a skyscraper and the problem of air conditioning older office buildings, is now under way at the 25 story Herald Square building, 1350 Broadway, New York City.

Representing an architectural solution to an engineering problem, as planned by Kahn & Jacobs, architects, it eliminates completely the need for utilizing valuable interior space by placing the chilled water risers of the air conditioning installation within stainless steel jackets on the exterior of the building. By incorporating the entire layout into the design treatment of the facade, an entirely different and strikingly modern appearance is given the building.

At 1350 Broadway — which, according to Jaros, Baum & Bolles, consulting engineers, will be the only older structure in the city's garment district to be completely air conditioned — the risers are being installed on the south side of the building facing Herald Square. The turbine driven compressors and the pumps for circulating the chilled water through the risers will be housed in the basement and subbasement, respectively, of the building.

Branch lines carrying the chilled water from the risers into the corridors of the building on each floor will be hidden between the original 10 ft high ceilings and new, furred, 8 ft ceilings. Conduits from the branches lead into each office.

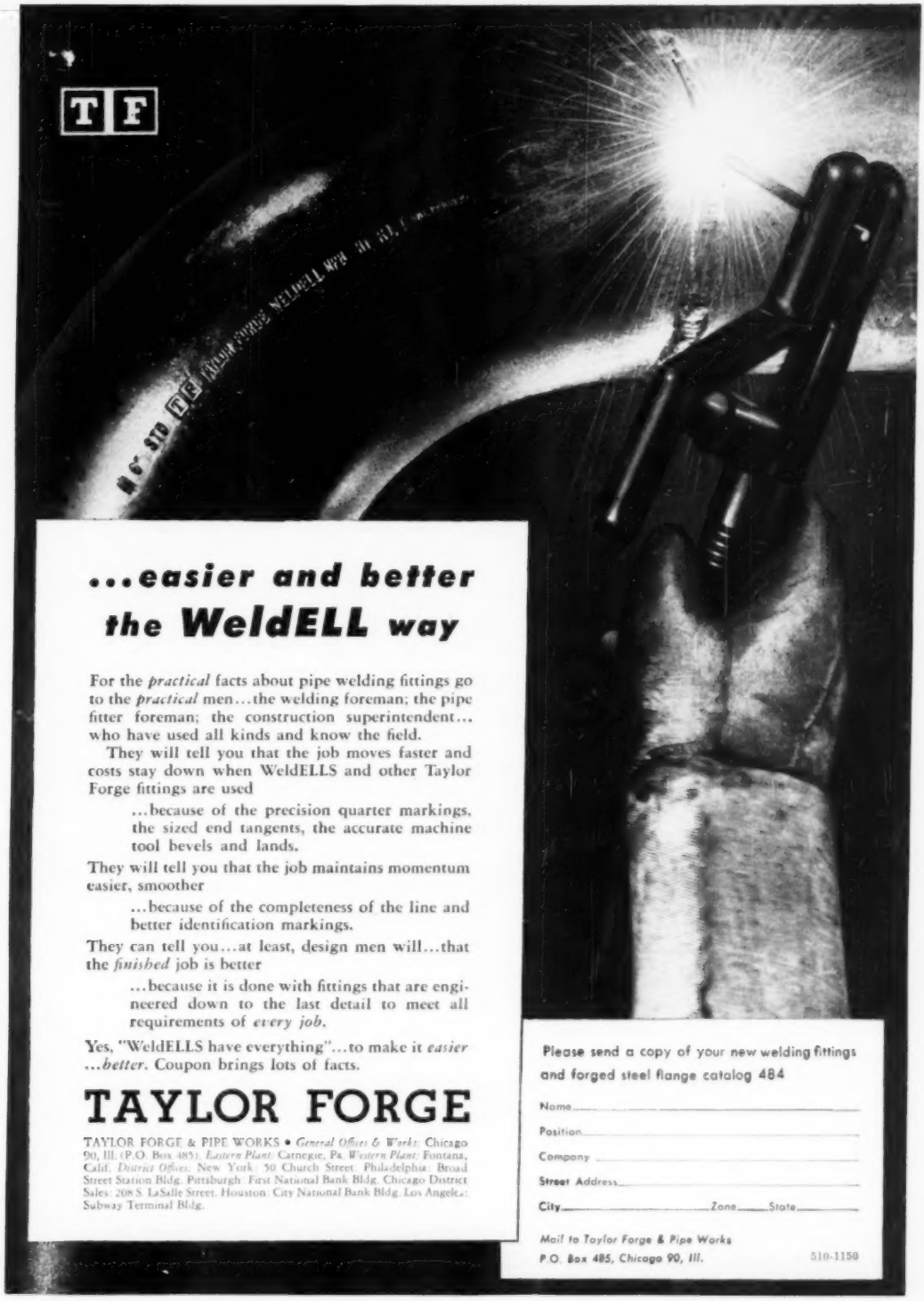
## COOLING TOWERS PAYING OFF AT THE WALDORF

WATER SAVINGS of approximately $25,000 a year are estimated to be realized at the Waldorf-Astoria hotel, New York City, as a result of the installation of two cooling towers on the 20th floor setback last spring at a cost of about $250,000 according to T. J. Barrett, building superintendent of the world-famous Waldorf. It was contemplated for some time to install cooling tower equipment because of the obvious economy that could be expected but the final decision was delayed on account of architectural considerations. The regulation of the New York water commissioner denying use of city water for comfort cooling was a "moving factor" in making the installation this year.

There is approximately 2000 tons of refrigeration for air conditioning, using some 6000 gpm of condensing water, at the Waldorf. Since air conditioning often runs 24 hr a day, tremendous water quantities are required.

The towers are completely fabricated of steel, and are designed for easy access for cleaning and painting. [Photo courtesy United Conditioning Corp.]

$25,000 SAVING a year in water for air conditioning is expected by the Waldorf-Astoria as the result of the new cooling towers

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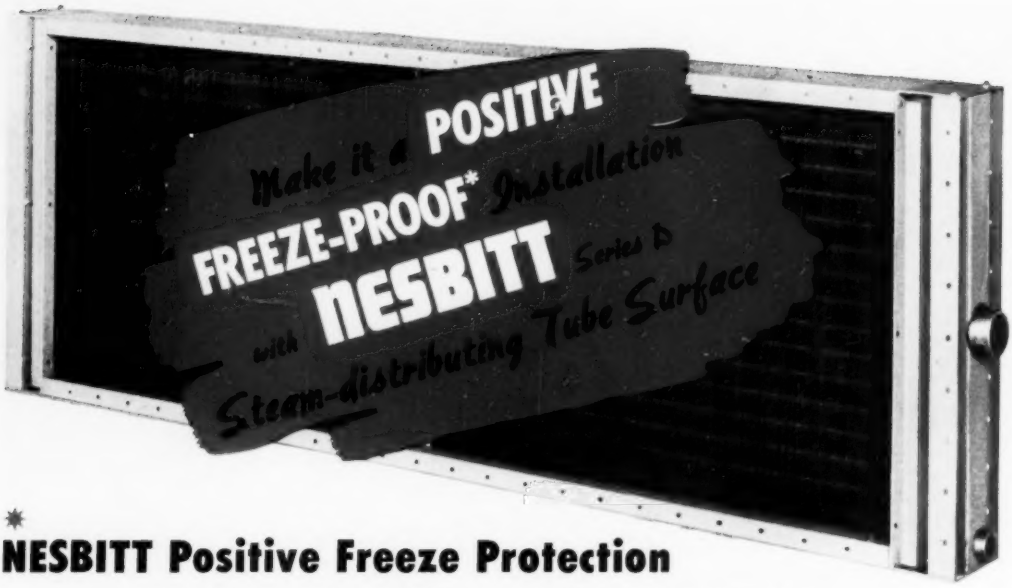


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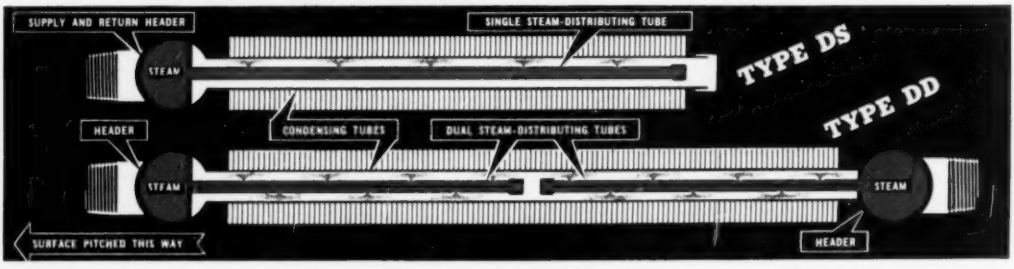


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• DO YOU HAVE something you'd like to say about any of the articles published this month? An additional comment, or perhaps a question on some point? Or do you want to express your views on some other matter of interest to heating, piping and air conditioning engineers or contractors? We follow here the custom at engineering society meetings of providing an opportunity for discussion following presentation of a paper. You are invited to participate. Just address your remarks to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.

## HOSPITALS NEED GOOD ENGINEERS

AIR CONDITIONING of operating rooms, as presented by R. A. Phelps in the August HPAC, and the discussion by Gerald C. Dittman and Lester T. Avery in September, has been very interesting. Each man has his own merits. Mr. Avery hits a real keynote in stating "you are dealing with a number of tough variables (including the medical staff)." I would expand his statement to include the administrative, surgical and maintenance staffs.

Normally, the medical staff would have little voice in operating room air conditions. The hospital administrator, with the approval of the board of directors and the advice of the hospital's engineer, would select the design and sign the contract for installation of equipment. The members of the surgical staff are the ones who work in the operating rooms and would have a large voice as to what they wanted or did not want. The maintenance staff maintains the equipment and has to keep the doctors, nurses and patients happy.

Now, note the position of the hospital's engineer (the term engineer meaning a person who is qualified by education, experience and law to practice professional engineering). He advises the administrator in design and selection of equipment, he supervises the installation, he supervises the operation and maintenance of the equipment, therefore, in my way of thinking the hospital's chief engineer is the key man in providing adequate and safe air conditioning in the operating rooms. He has a broad enough knowledge so that he can prevent the compromise job based on cost and the "handbook artisan" who may have established a commercial reputation with makeshift equipment.

Engineering no longer stops with the design and construction of a hospital. Experience has proved that daily problems arise which require good engineering knowledge to solve.

The big job that the engineering profession has, in my opinion, is to convince hospital management of the advantages in employing qualified engineers and to stimulate engineers to seek permanent employment with hospitals. It would seem to me that the American Society of Heating and Ventilating Engineers could adopt such a program as a civic responsibility. With qualified engineers employed by each hospital, the society would gain in the end by providing entirely adequate heating, piping and air conditioning services.—J. A. MILLARD, chief engineer, Charleston (W. Va.) General Hospital.

## ADLAM WRITES OF EUROPEAN TRIP

DURING MY TRAVELS through Europe this spring, I had the pleasure of meeting heating engineers in almost every European country outside the "iron curtain," and at conferences I met engineers from India, South Africa, Australia and New Zealand. Many were personal friends whom I had not seen for many years, and since those of my friends living outside Great Britain have traveled far during the intervening period, the greetings were exceptionally warm and sincere.

However, regardless of the time or occasion of such friendly greetings, it seems that engineers must always talk shop, so that when heating engineers meet there is inevitably an exchange of ideas on such subjects as heating and air conditioning. Then again, the friendly rivalry relating to ideas and quality which invariably enters into such meetings makes the discussions much more real and interesting. Naturally, the ideas which dominated the minds of heating engineers from so many different countries varied somewhat, mainly because of the peculiar conditions which exist geographically. However, at the present time, the financial conditions of the countries and the money which can be made available for suitable equipment are also dominating factors.

Nevertheless, these meetings did present many splendid opportunities to discuss with other engineers the outlook and possibilities of the various methods used, and to learn of their personal experiences under the varied conditions which exist in the different countries.

The subject matter involved in relating the trends only would be much too large and comprehensive to cover in a short resume'. I will, therefore, make a few informal remarks and leave the problems until a later date, because I was on occasions faced with some very pertinent questions. Among some of the things I learned was the interesting fact that articles which appear in American journals are studied very thoroughly, especially in Great Britain and the Scandinavian countries. Some engineers from the other European countries and also those from the British Dominions appeared to be well versed in what we are doing in America, indicating that they too follow our literature quite closely.

Broadly speaking, my impression was that heating engineers in most of the countries were very interested in radiant heating and were very anxious to learn of the methods we in America are adopting with the newer types of buildings. They were also

interested to know what other types of heating were gaining favor in this country. In this respect, many seemed well versed in the different types of automatic controls made in America for the various methods of heating and air conditioning — some of which they have apparently tried with good results.

Financial conditions are, of course, against purchasing equipment from the U.S., but engineers are keenly interested in what we are doing — especially the details of the equipment used. This interest not only applies to heating equipment itself, but also to steam boilers for high and low pressures and other kinds of equipment for industrial uses.

In England, I found a very keen interest in the heat pump and its possibilities. This is quite natural since it was the noted English physicist, Lord Kelvin, who first brought the idea to the minds of practical engineers. A number of successful installations stand to the credit of the British engineers, from which some very useful data have been compiled.

I inspected a number of heating installations during my travels and while it is not suggested that heating engineers in the countries I visited are better qualified than some of the engineers in America, it does seem to be evident that the methods adopted in some countries are more consistently good than one finds over here. It is only natural that when heating engineers have to give clients a real guarantee of five to eight years against cracked ceilings or damaged floors, every precaution has to be taken against undue expansion and overheating of the surfaces and the best workmanship becomes imperative.

While we in America are not usually called upon to give such stringent guarantees, we undoubtedly have an obligation to our profession which should be our first consideration. Consequently, it is sometimes very discouraging to reliable engineers when dangerous shortcuts and dubious methods are advocated as being "good enough," when actually only the best should be recommended. The experienced engineer can often take the shorter route after he thoroughly knows the way, but unless young engineers are taught first to understand the fundamental principles of heating and air conditioning, it becomes a very perilous situation.

As to the living conditions and the spirit which exists in the European countries, these have undoubtedly improved, but living conditions in most instances appear to be still below prewar levels. All the allied countries are just now on the way to recovery and in Great Britain the dollar gap is gradually being closed, while Italy and France are winning the war against inflation.

It is true that the people of these countries do not talk war and there appears to be less evidence of nervous tension in most of the countries than we find here in America, but in talking to "the plain people" of Europe one finds that they do not talk war because they are always thinking of its possibility. They feel that regardless of what may happen in Asia or any other part of the world, if a showdown does come, Europe will be the deciding place.

Sweden seems to be much better placed than any of the other countries, although they claim to be still poor. In most cases, the large stores are well stocked with some of the best merchandise the world produces. In the stores at Stockholm, one could purchase at quite reasonable prices the best commodities which England produces, although it was impossible to obtain these same quality goods in any of the London or provincial stores.

England showed true signs of recovering steadily and the people, while still subject to many restrictions, did not appear to be disturbed or unduly annoyed by the fact that nearly all their large stores display the best British made goods with a large notice that these exhibits were for "Visitors Only". These goods cannot be purchased and taken away by Britishers, even though American dollars are offered for payment. The British people feel that it is for the good of their country that these goods are exported while they themselves have to be satisfied with utility clothing and other second grade commodities.

Norway, while it is a very lovely and picturesque country with most hospitable people who made our stay an outstanding event, appears to show more definite signs of "austerity" than any of the countries visited, and the stores in the large cities appeared to be almost empty compared with the well filled stores of Stockholm and Paris.

Paris is as intriguing as ever and a trip to Europe is not complete without a few days in that city. Paris itself shows very little signs of the war, but much devastation can be seen in other parts of France. The many cemeteries with their thousands of marked graves are mute reminders of what happened to youth of this and other countries fighting for freedom.

The people of France appeared to be more serious than in prewar days, and judging from our own factory in Paris, and a few others I visited, the work people appear to be more attentive to their work — although the work people in some of our factories in other countries appear to work harder and take less time off for meals.

There appears to be less talk concerning communism in the countries visited, and in some instances the democratic ideal seems to have taken on a new spirit. In all cases, however, the opposition to any trend toward communism is, undoubtedly, very strong and sincere.—T. NAPIER ADLAM, vice president, Sarco Mfg. Corp.

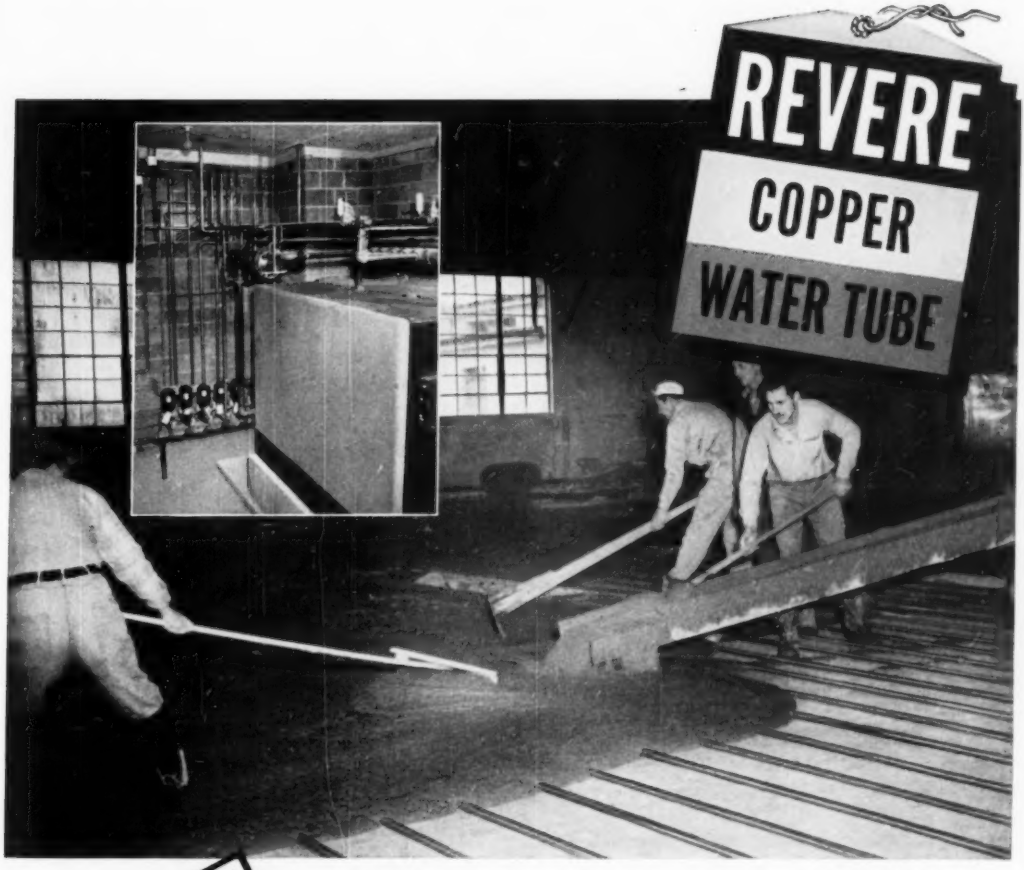
* * * *

*Watch for the complete Directory Section to be published in the January issue, which will classify heating, piping and air conditioning equipment, give complete addresses, and list trade names.*

### Willis H. Carrier

DR. WILLIS H. CARRIER, chairman emeritus of the board of the Carrier Corp., and known widely as "the father of air conditioning", died October 7. Active as a scientist and engineer in the air conditioning and refrigeration fields for half a century, he devoted himself principally during the last few years of his career to writing and to advising scores of engineers he had trained to carry on his work.

It was in 1902 that he developed and installed "the world's first scientific air conditioning system." In 1911, he delivered his fundamental paper, Rational Psychrometric Formulae, before the American Society of Mechanical Engineers.




OK

*Concrete is being poured over 1" Type L Revere Copper Water Tube in this radiant panel heating installation at Driscoll Chevrolet Agency, Spring Valley, New York. Boiler and zone circulators are shown in inset.*

*Architect: Joseph M. Pilati, Pearl River; General Contractor: Harvey B. Keesler, Spring Valley; Heating and Plumbing Contractor: Irving Keesler, Spring Valley; Consulting Engineer: Roger M. Wells, Bayside, Long Island.*

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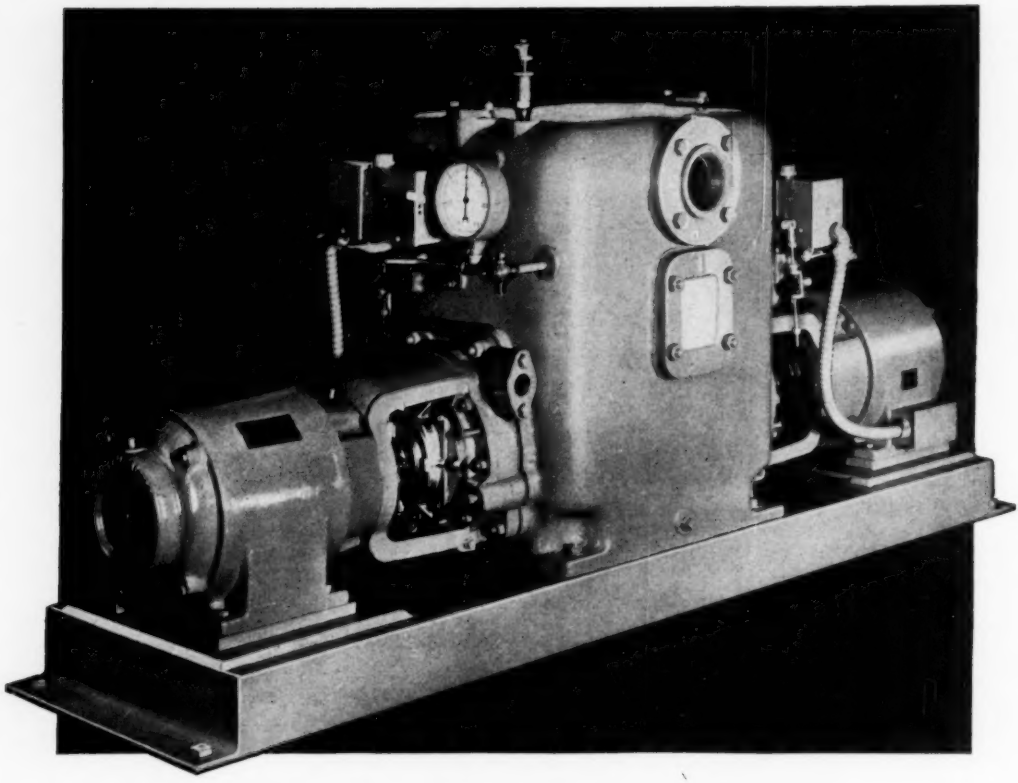

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# New Air Conditioning Design for Stores

**A. T. Spangler, Carrier Corporation, describes new system for air conditioning department stores and its first application at Kaufmann's, in Pittsburgh**

STREAMLINED DUCTS, 14 by 7 in., one to a bay, run as close to the existing beams as possible, appear to be part of the beam construction

LOWERED CEILINGS, where they occur, have the ducts above them, with drops to the special high velocity air diffusers mounted below

DEPARTMENT STORE air conditioning requires the solution of many apparently complex but characteristic problems. The structure usually contains relatively large floor areas, many of which are broken up into the smaller areas of departments and specialty shops. These smaller areas often have varying ceiling heights. In all cases — whether large open floor areas or small partitioned areas — the load problem is complicated by lighting and occupancy of changing intensity.

The greatest problem, however, is the one that complicates all others — the constant change that occurs in a modern department store employing modern merchandising methods. As a result of a good merchandising arrangement, departments are constantly enlarging and decreasing in size and frequently they are also completely relocated — resulting in complete rearrangement of large areas.

These changes in department location, department fixture arrangement and partitions are accompanied by the resultant changes in lighting and people loads, all of which alter the air conditioning requirements. These changes in air conditioning loads usually require extensive changes in the air distribution system in order to maintain satisfactory conditions of temperature, humidity, air circulation and ventilation.

The seriousness and cost of these changes are affected somewhat by the general nature of the building and more particularly by the type of air conditioning system that has been installed.

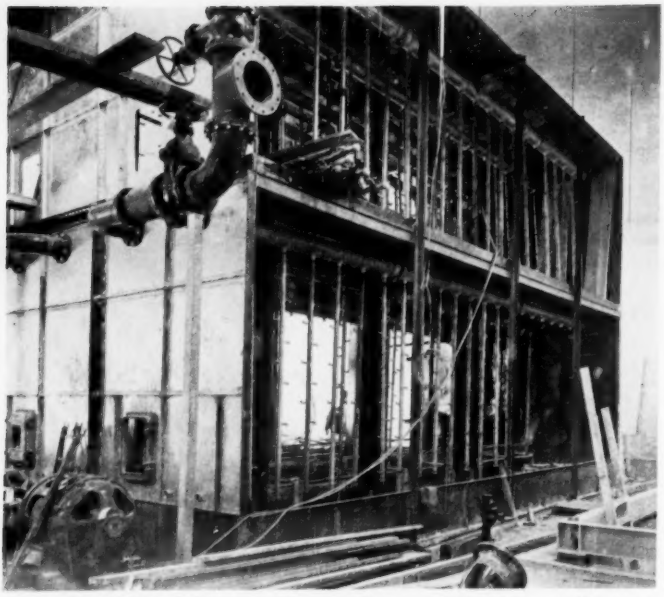
### Two Methods Currently Used

There are two general types of department store air conditioning systems currently in use — unitary and central station.

The unitary system may consist of either self-contained units having their own refrigeration machines built into the unit or of unitary sets of air handling equipment, with a separate refrigeration system serving the various units.

The central station system usually consists of several sets of central station air handling equipment supplied either directly by individual refrigeration machines or by a central refrigeration system.

There is no great difference be-



SPRAY DEHUMIDIFIER, two stage, has stainless steel inlet baffles and eliminators. Piping is arranged for one stage operation when outdoor conditions permit

tween the so-called central station type of system and the unitary system except that the central station is larger in size and capacity and can serve an area equal to that requiring several units. In conventional practice, central stations range in capacity from approximately 30,000 to 50,000 cfm (which is equivalent to from four to six fair sized units.) In many instances, one central station is used per floor in place of four or five units. When applied in this manner, the system is usually zoned in a manner that makes it comparable to the zoning naturally achieved by using unitary equipment.

A review of the unitary and small central station type of systems reveals that both types have some serious shortcomings and present several major problems, particularly for installation in existing buildings. These objectionable features are:

1) Cost of services such as wiring, chilled water and condenser water piping, insulation, and drains to units distributed over a large area.

2) Difficulties in providing suitable outside air intakes, and electrostatic filtration.

3) Interference with store operation by multiple installation problems involving the sheet metal, steamfitter, electrical and insulation trades.

4) The cost of cutting, patching and redecorating in existing stores for installation of this equipment and its accompanying relatively large low velocity duct system together with the valuable floor space required for equipment of this type.

5) The complex operating and maintenance problems due to the multiplicity of units and the need for undesirable continuous traveling of maintenance and operating personnel through the sales area, with the high cost of "walking time."

## New System Devised

In order to overcome as many of the objectionable shortcomings as possible, a new system has been devised and the first installation of it has recently been placed in successful operation at Kaufmann's, Pittsburgh department store.

This design attempts not only to overcome shortcomings of other methods but to meet several other objectives established in conjunction with the management of Kaufmann's. These objectives were to provide a system that would require a minimum and, if possible, no usable floor space; apparatus to be as simple and as centrally located as possible to permit ease of operation and maintenance and requiring no travel of maintenance people through the sales areas; air distribution system to be uniform and completely adjustable to provide for future store layout changes without costly duct changes; distribution system to be as unobtrusive as possible and to require a minimum of interior store changes.

The design makes use of a single central station system which supplies the entire store through a uniform, high pressure air distribution system. Consolidation of all equipment into a central station located in a new roof penthouse provides close coupling and minimum cost of all services, wiring, piping, insulation and controls, as well as simplicity of installation and operation without interference with store merchandising operations or sacrifice of sales floor area.

The distribution system consists of a network of many small uniform high velocity distributing ducts which supply air to the store through specially designed, completely adjustable, single jet, high induction diffusers. With this type of distribution, complete flexibility for meeting all changes in merchandising layout is maintained with simple readjustment of the outlets and with no changes in the ducts themselves.

In addition to space savings achieved by the high velocities used, further savings are accomplished by supplying air to the space at lower than usual supply air temperature.

## Almost Half a Million Square Feet

As installed in the Kaufmann store, the system serves the second to 13th floors of the block square building, the first floor and basement having been previously conditioned with five central station systems. The total net floor area served by the air conditioning system, with deductions for necessary stair towers and elevators, amounts to 470,000 sq ft.

For an area of this size, a conventional system would have to supply from 550,000 to 600,000 cfm of air, but with the high induction outlet it has been possible to reduce the supply air to 400,000 cfm, which is the amount actually required to do the work when introduced to the space with a 25 F temperature difference.

The apparatus required to handle

this large volume of air, although tremendous in size, is still simple in arrangement and together with the new penthouse required for housing the equipment, it may be referred to as a "self contained" unit requiring only the provision of the necessary electrical and water connections.

The casing of this "self-contained" unit is the new air conditioning penthouse, 80 ft square and 30 ft high, which was built over the existing elevator machinery penthouse. Because of weight considerations, the penthouse walls and roof were constructed of special insulated metal panels.

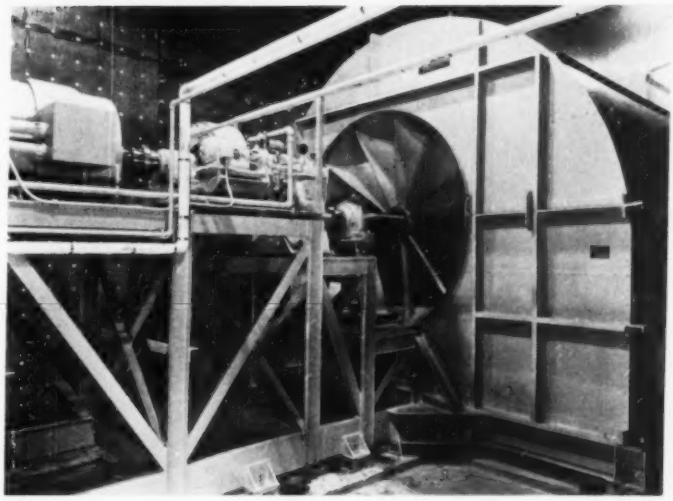
The air is supplied through a huge industrial type central station system consisting of a 50 ft x 20 ft x 28 ft return and outside air mixing plenum. Outside air enters the plenum through a 40 ft x 10 ft intake in the rear penthouse wall.

All the air, outside and return, is filtered through a bank of automatic electrostatic air filters arranged in two tiers with catwalks for access to the upper tier. The solution used in these filters as both a filter adhesive and cleaner is pumped through oil filters where sludge is removed and deposited in throwaway cartridges.

### Two Stage Spray Dehumidifier Used

After cleaning, the air is dehumidified in a two stage washer type dehumidifier, a spray type dehumidifier being used because of weight considerations and the construction difficulties involved in adapting coils to a unit of this size. Because of the size of the dehumidifier, an intermediate collecting pan is used for collection of the spray water supplied to the upper half of the dehumidifier. Use of two stages of dehumidification, with counterflow of water to air, made it possible to design the system using 47.5 F chilled water as compared to the 41 F temperature for a single stage dehumidifier, thus saving refrigeration machine horsepower. Inlet baffles and eliminators are constructed of stainless steel in order to withstand the normal corrosive atmospheric conditions peculiar to the Pittsburgh area.

A pump driven by a 150 hp motor is used to pump the spray water from the second air stage to the first stage of the dehumidifier. A second pump of similar size but with a 200 hp motor is used for pumping the spray water from the first air stage through the coolers of the refrigeration machine and back to the second stage of the dehumidifier. The spray water piping is arranged with the necessary bypass connections to permit operation of but one stage of the dehumidifier when outside air temperature conditions permit.



HYDRAULIC COUPLING overcomes starting problem imposed by mass of large fan wheel, permits speed variation through use of static pressure regulator

After dehumidification, the air is supplied to the air distribution system by a double width, double inlet fan driven by a 400 hp motor through a hydraulic coupling and speed reducing gear all direct connected to the fan.

Use of the hydraulic coupling overcomes the starting problem imposed by the mass of the large fan wheels. It also permits variation of the fan speed through use of a static pressure regulator, thus controlling fan performance to meet load requirements as determined by the outlet adjustments.

### Abandoned Elevator Shafts for Air

The supply air is discharged downward into two abandoned elevator shafts, now being used as a supply air shaft. This shaft is located in the approximate center of the store. At each floor a sheet metal takeoff is made on each side of the shaft.

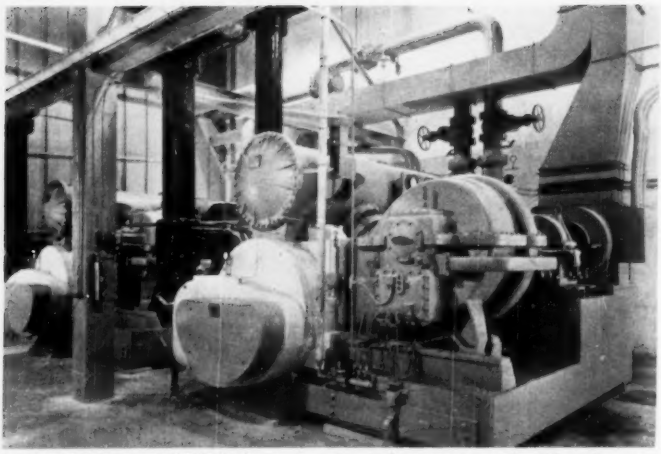
These takeoffs consist of a carefully designed vaned elbow, fire damper, volume control damper and sound absorber cell. After the sound absorber cell, the duct is split and run parallel to the elevator bank to form a supply header running from the center to both front and rear of the store on both sides of the main elevator bank.

From these headers, small 14 x 7 in. ducts are run out across the width of the store. These runouts are made, one in each bay, as close to the existing beams as possible. Because streamline duct construction was used throughout, the ducts are smooth and free of standing seams or ribs and after being painted, they appear to be a part of the beam construction.

### Special High Velocity Air Diffusers

The high velocity diffusers specially developed for use on this installation [see page 101, September HPAC] are mounted, three per bay, on the bottom of the 14 x 7 runout ducts. Where sections of the ceiling have been lowered, the runout ducts are installed above the ceiling with drops to the outlets mounted below.

The distribution system has been designed to supply considerably more air than required for uniform load distribution in order to provide for areas having concentrated light and people loadings. For lightly loaded areas (such as stockrooms, etc.) the outlets have been greatly



CENTRIFUGAL COMPRESSORS—two, each rated at 575 tons of refrigeration—are installed in penthouse. Total motor load for system is about 2400 hp. There are provisions for a third machine

throttled. Because of the ease with which the outlets may be adjusted, any desired air quantity to meet any new load condition is readily available.

Return air from the various floors is taken into the return air shaft. This, like the supply shaft, consists of two abondoned elevator shafts. The air is drawn through the shaft to the penthouse by a combination exhaust and return fan which is similar to the supply fan but with a 200 hp drive assembly. The air is discharged to outdoors or returned to the apparatus as determined by the dew point thermostat and the minimum setting of the outside air damper.

### Two 575 Ton Centrifugals

The refrigeration equipment consists of two 575 ton, 600 hp centrifugal compressors with provision for a third machine to be installed at a future date. These machines are in the penthouse adjacent to the air handling equipment.

Condenser water for these machines is provided by a cement asbestos sheathed red wood cooling tower on the roof of the store just beyond the penthouse. City water used in the oil coolers for the hydraulic couplings and speed changing gears is piped to the tower and provides more than an adequate supply of makeup water for the cooling tower.

The total installed motor load required to operate this huge plant amounts to approximately 2400 hp. In order to double the size of the electric supply to the store, a new electric substation was erected on the roof and is fed by four 11,000 volt feeders brought from the street to the roof through a conveniently located stair tower.

### Simplicity Features Control Scheme

The automatic control installation is notable because of its simplicity. It consists chiefly of a dew point recorder controller which governs the capacity of the refrigeration machines through control of their suction temperatures. For protection against freezing, the controller operates through low limit thermostats measuring the leaving water temperature from each machine. The centrifugal machines are also provided with standard high and low pressurestats, freeze protection thermostats and oil pressure safety switches.

During winter and intermediate season operation, the dew point controller is arranged to control the outside, return air and exhaust air dampers. These are all interconnected through line shafting to assure synchronization of the dampers at all times and are so arranged to assume a position providing minimum outside air when the supply fan is in operation. This minimum position can be varied through a manually operated gradual switch in order to allow for store flushing at start-up, recirculation before store occupancy and for variation of ventilation according to required demand as determined by the store occupancy.

A return air thermostat is used to measure the average return air temperature and to control a bypass damper in order to maintain this temperature.

Zone control is provided by volume dampers at each floor takeoff from the supply air shaft controlled by thermostats located in each half of each floor. It has been determined that 10 percent throttling of air is sufficient to provide the required zone control on this installation.

Static pressure regulators control the speeds of both supply and return air fans through their respective hydraulic couplings, in order to maintain constant pressure in both air shafts and thus allow for variations in air quantities as determined by the outlet adjustments in the store.

To date, the performance of the system has been extremely satisfactory with the air distribution being the most outstanding feature. Air circulation is quite adequate even with greatly reduced amounts of supply air; at the same time, objectionable drafts have been found to be virtually non-existent.

### Horsepower and Cost Advantages

The apparent larger horsepower requirements for refrigeration because of lower dew points and for air because of high pressures are compensated for by smaller horsepower requirements due to the greatly reduced air quantities and operating costs are therefore approximately equal to those of conventional systems.

Because of the ease of installation of the small ducts and the economy of one central station, the initial installation was made with an approximate 25 percent saving in cost from that of a conventional system. In addition, because of the system flexibility, there will be no future costly duct changes required to provide for even the most extensive departmental rearrangements that are needed.

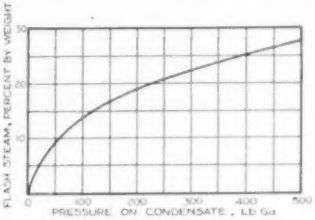
# How to Recognize Flash Steam in Trap Discharge

***T. H. Rea, Armstrong Machine Works, explains why flash steam occurs and how it can be recognized. In the few cases where flash steam causes trouble, he tells what the trouble is and how to correct it***

THE SIGHT OF white steam blowing away in the open air is likely to cause any cost-conscious engineer to do slow rolls. His immediate thought is to get at that blankety trap and put things right. An interesting switch, however, is the fact that this white steam might well be a sign that the trap is performing its function perfectly — it is taking condensate at steam temperature out of a unit that contains steam under pressure. Such is the case with flash steam.

## How Flash Steam Occurs

Under pressure, steam can become condensate even though the temperature exceeds that of the normal boiling point of water, 212 F. When this water is released to the open air or to a lower pressure, it reverts to a




**PERCENTAGE of flash steam that forms per pound of water (at the boiling point for the pressure indicated) discharged to open air**

vapor state — "flashes" into steam because of the sudden liberation of excess heat which the water contains.

It is only natural, therefore, that flash steam occurs in the discharge from a steam trap. If the trap discharges to the open air, the formation of flash steam will be visible; but if it discharges into a return line, the flash steam will be out of sight and will be quickly condensed by radiation losses from the return line.

In about 99 cases out of 100, flash steam will never do any harm. Nevertheless, many trap users become confused by the appearance of clouds of flash steam and naturally fear that it is a leakage of live steam. Here is a simple rule for distinguishing flash steam from real steam leaks that can be prevented.

First, disconnect or open up the outlet line on the trap. If a continuous blow of "blue" steam occurs, it is a real leak and the trap valve should be inspected; but, if steam is only visible intermittently at the time the trap discharges, then it is only flash steam.

Probably the chief reason that flash steam is so confusing is due to its great volume. At atmospheric pressure, steam will occupy about 1650 times as much space as the water from which it was formed. The accompanying charts show the relation flash steam bears to the water from which it is formed when discharged from various pressures. One chart shows the percentage by weight of flash steam that forms per pound of water (at the boiling point for the indicated pressure) discharged to open air. The other shows the cubic feet of flash steam that forms under the same conditions when 1 cu ft of water is discharged to open air. Following is an example showing how these figures can be calculated.

Referring to a steam table, it will be noted that at 100.3 lb ga pressure, the boiling point of water is 338.1 F and 1 lb of this water contains 309 heat units (Btu). As a pound of water at the boiling point under atmospheric pressure contains only 180 heat units, the difference (309-180) or 129 heat units are liberated when this water is discharged to the open air.

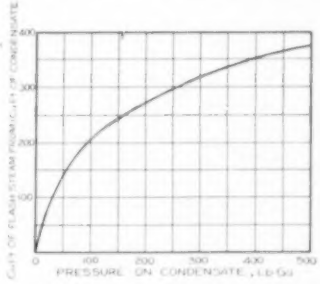
Practically all of this heat is immediately used in evaporating a portion of the water from which it was released. The percentage of condensate flashing into steam can be found by dividing the surplus heat units by the number of heat units required to evaporate a pound of water at the lower pressure. In this case, 129 divided by 970.4 or 13.3 percent of the total discharge by weight is changed to steam.

As mentioned above, a given weight of steam at atmospheric pressure occupies some 1650 times as much volume as a given weight of water. Assuming that 1 cu ft of water at 338.1 F is discharged, then 0.133 cu ft will flash. The steam volume would be 1650 times 0.133 or 220 cu ft.

## Causes of Flash Steam Trouble

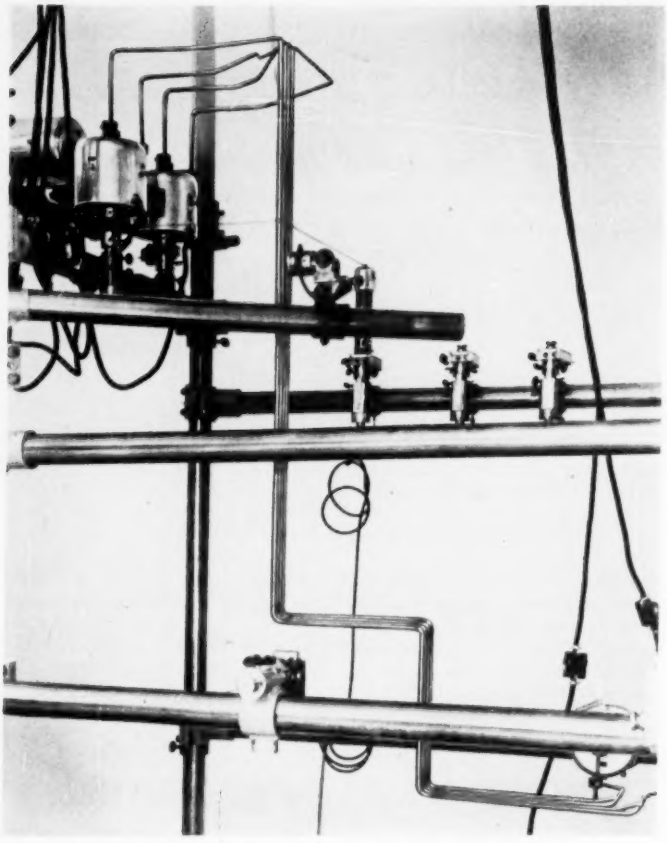
In the small percentage of cases where flash steam may cause trouble, the trouble is not due to loss of heat but to the bulkiness of the steam. Thus, when a trap discharges into an undersize return line, the formation of flash steam may cause back pressure to build up and then the capacity of the trap is materially reduced. The solution for this trouble is to install a larger return line.

One more possibility of trouble with flash steam is when a long or undersize inlet line is used on a trap. In such cases, the drop in pressure that takes place when the trap discharges extends even into the inlet line and flash steam may form. This steam will float the trap bucket, thereby closing the discharge valve,




**CUBIC FEET of flash steam that form when 1 cu ft of water (at boiling point for the indicated pressure) is discharged to open air**

even though the inlet line is full of water. The solution for this is to install a larger inlet line so that the pressure drop in the line will not be great enough to allow the formation of flash steam.



FOUR-PIPE main steam line is used to reduce cost and improve flexibility. By means of the electrical force- and moment-determining heads of this test equipment, it is being analyzed for operating stresses and reactions.

# Four-Pipe Main Steam Line for New Central Station

**W. Mc. McKee, of the M. W. Kellogg Co., describes briefly some of the unique piping designs being used for the new addition to Consolidated Edison Co.'s Hudson Ave. Station in Brooklyn**

A UNIQUE four-pipe main steam line is to be used in the new addition to Consolidated Edison's Hudson Ave. Station in Brooklyn, N. Y. The main steam system will operate at 1050 F and 1500 psig. It will take steam off the largest boiler in the world (1,370,000 lb per hr) to a 60,000 kw topping turbine. This turbine exhausts 1,000,000 lb per hr of steam at 280 or 410 psig to eight existing low pressure turbines.

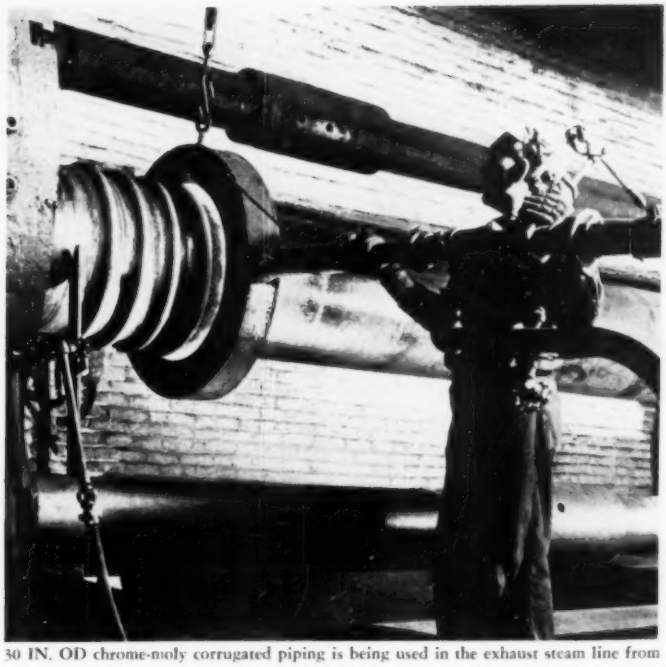
Due to the unusual amount of steam passing through the main steam line, it was decided to use the four-pipe construction to feed the topping turbine. The use of multiple piping instead of a single pipe not only reduces the cost of the installation but also provides for necessary flexibility. Steam from the new turbine is to be exhausted into the existing low pressure system, thus measurably increasing the overall plant efficiency. All piping is 2¼ percent Cr. 1 percent Mo alloy steel.

Since this system has six terminal points as well as a complicated supporting arrangement, solution by model test is most economical.

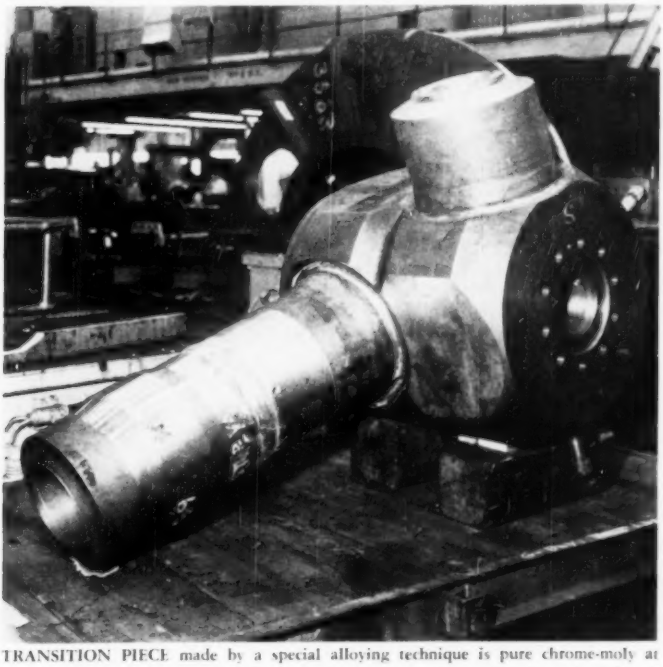
By means of this model test, shown in one of the photos, it was possible to obtain accurate data on operating stresses through readings from the electrical force- and moment-determining heads. Included in the system as set up on the model test apparatus are the four 10 in. diameter leads from the boiler (top) to the two 14 in. diameter connections to the turbine stop valves and steam chests (bottom).

### 30 In. Corrugated Chrome-Moly Piping

The first 30 in. OD, chrome-moly corrugated piping was recently manufactured for use at the station. Totalling some 90 ft overall, eight pieces of this large diameter pipe were used for the major part of the exhaust steam line from the topping turbine to afford adequate flexibility. The pipe was made from chrome-moly plate bent up to form cylinders which were longitudinally welded. All welds were radiographed to insure soundness.



30 IN. OD chrome-moly corrugated piping is being used in the exhaust steam line from the topping turbine. Corrugating required carefully controlled heating and subsequent compression on this specially devised machine



TRANSITION PIECE made by a special alloying technique is pure chrome-moly at one end, pure stainless at the other. In this view, transition piece is at the left and a valve is at the right

Beyond physical size itself, the major problem in fabrication was to preclude cracking, a defect much more apt to occur in forming chrome-moly than in working either carbon or carbon-moly steels. The corrugations were formed through carefully controlled incremental heating and subsequent compression. The corrugated piping has five times the flexibility of plain piping.

### Chrome-Moly, Stainless Transition Pieces

Another piping feature of this central station installation is the use of transition pieces for the connections between the main steam pipes and the turbine throttle valves. In this operation, stainless steel is cast integrally on a chrome-moly forging. A special alloying technique is employed in the casting process which results in a gradual transition from one metal to the other. The piece—pure chrome-moly at one end and pure stainless at the other—is then machined to the correct inside and outside diameters.

## UNIFORM CONTROL VALVE DIMENSIONS GIVEN

A "FORWARD STEP" in the direction of standardization was taken recently, says the Instrument Society of America, when information was released that control valve manufacturers are able to supply flanged control valves conforming to the face to face dimensions shown in the accompanying table. This accomplishment is a result of a joint effort of the National Steam Specialty Club and the ISA.

These uniform face to face dimensions are being considered for official endorsement by the ISA recommended practices committee, which should be only a matter of formality.

Uniform standard face to face dimensions of flanged control valve bodies

| Pipe Size, in. | 125 psi iron 150 psi steel See Note 1 | 250 psi iron 300 psi steel See Note 2 | 600 psi steel See Note 3 |
|---|---|---|---|
| ½ | —— | 7½ | 8 |
| ¾ | —— | 7⅞ | 8⅛ |
| 1 | 7⅛ | 7⅞ | 8⅝ |
| 1½ | 8¾ | 9¼ | 9⅞ |
| 2 | 10 | 10½ | 11¼ |
| 2½ | 10⅞ | 11½ | 12¼ |
| 3 | 11⅝ | 12½ | 13¼ |
| 4 | 15⅞ | 14½ | 15½ |
| 6 | 17½ | 18⅞ | 20 |
| 8 | 21⅝ | 22⅝ | 24 |

Note 1—Cast iron bodies with 125 psi ASA B16a-1939 flanges, and steel bodies with 150 psi raised face ASA B16e-1939 flanges.

Note 2—Cast iron bodies with 250 psi ASA B16b-1944 flanges, and steel bodies with 300 psi raised face B16e-1939 flanges.

Note 3—Steel bodies with 600 psi raised face ASA B16e-1939 flanges.

NEW YORK City Housing Authority has over 62,000 individual apartments complete or under construction. This is a view of the Jacob Riis project

# How World's Largest Landlord Heats Low Cost Housing

***Heating procedures and details adopted by the New York City Housing Authority for its hundreds of buildings are of wide interest to the heating trade and to housing authorities throughout the country. Lewis Smith (of the C. A. Dunham Co.) has been closely concerned with heating buildings of this type, reviews the New York methods and their background in this very practical article***

PERHAPS IT is not correct to say that the New York City Housing Authority is the largest landlord in the world—the Russians might claim that distinction—but it is certain that it is the largest landlord in this country. By the end of this year, some 230,000 persons will be living in its projects. Plans point to the ultimate housing of around 500,000 in this form of low rent public housing.

Organized in 1934, the authority started in a small way with a 123 family project completed in 1936 and financed through federal agencies. In 1936 and 1937 two large projects were completed by the Public Works Administration of the federal government and leased to the authority. Then, under the U.S. housing act of 1937, seven projects were completed by 1941 and during the war the largest one of all was built near the Brooklyn navy yard to accommodate 3500 families of war workers. This project has the distinction of being the first in the country to be built with state aid.

The first post-World War II construction was undertaken as an emergency measure and the buildings were of a temporary nature, but by the end of 1949 10 permanent projects were completed and no less than 25 more were under construction, the

latter including 27,000 apartments estimated to house 94,500 persons. As of June 1950, announcement had been made of five more permanent projects to be built under the national housing act of 1949 to accommodate 7728 more families, with several more to follow. This makes, as of today, completed or under construction, a grand total of 53 projects containing 62,123 apartments in 778 buildings.

These facts are recited to show the immense scope of the operations. Quite obviously, a large organization is necessary—one which can well afford to employ the best engineering talent and one which could hardly afford to be without the benefit of such talent.

It is the vogue to think of federal, state and city work as extravagant, wasteful and inadequately designed. Especially is this true when subsidies are involved, such as are required to make these projects available to tenants who could not otherwise find decent living quarters within their limited incomes.

Fortunately, these criticisms cannot be levelled at the New York City Housing Authority. On the contrary, the mechanical equipment has been selected with the proper balance between first cost, efficiency, suitability and durability. To argue whether public housing is a right or wrong approach to the problem of providing adequate and proper living quarters at the taxpayers' expense is not the concern of this article.

### How Equipment Is Selected

The following factors have been and continue to be considered in the selection of heating equipment for large scale, low rent, public housing projects, which differ in some respects from private work.

1) While appearance is a factor taken into consideration in design, it is not as important as first cost.

2) The multiplicity of items makes it essential that each be as simple and as rugged as possible to hold the maintenance cost at a minimum.

3) Because of the size of the projects, even small savings in fuel become unusually big in dollars and cents.

4) Due to the long range investment, equipment may be evaluated over a period of 40 years and more.

5) Being built and subsidized with taxpayers' money, caution must be used in adopting equipment not already thoroughly proved in use elsewhere.

6) Free competition must be assured.

7) The tenants must be afforded reasonable average comfort but not the individual preferences accorded in higher cost, privately financed and owned projects.

Bearing these factors in mind, the authority and its consulting engineers made many studies of the various types of heating equipment available. The authority was broad-minded enough to realize that it would be a mistake to consider its own organization self-sufficient for these studies and wisely sought the help of several prominent consulting engineers.

It should be remembered that for an operation of this magnitude, small items—like saving only a few cents on each radiator setting—bulk extremely large when applied to the some 140,000 radiators installed to date. Thus, studies which would ordinarily seem picayune are very much worth the cost here.

Given the criteria set by the authority for the selection of heating equipment, it is most interesting and informative to see what has been actually installed and what the results are to date. Such a survey is of interest to the heating trade in general and especially to the many new housing authorities all over the country, many of which cannot afford to go so deeply into these problems.

Let us begin with the consumption equipment; that is, the heating systems in the apartments, as distinguished from the generation and distribution systems.

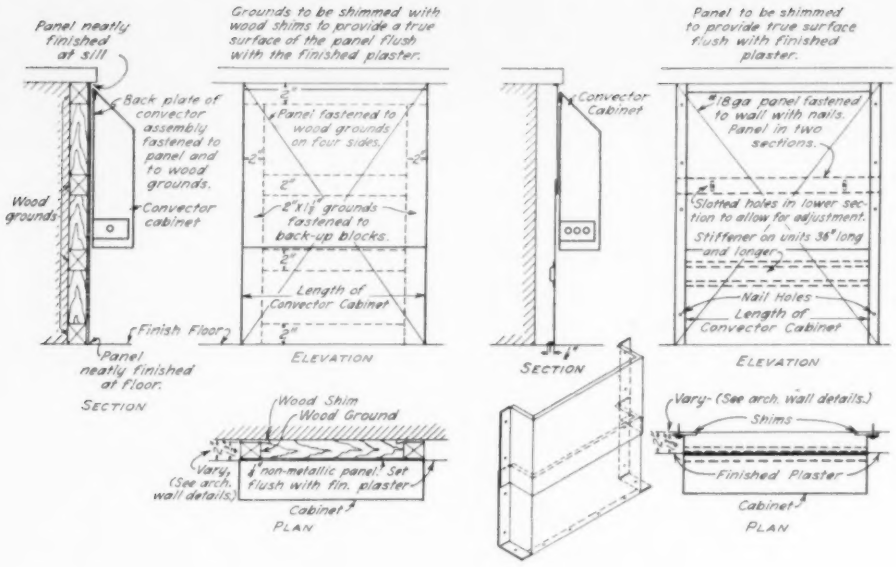
### What Form of Heating Unit?

Small, quiet operating heating units built into closet spaces have been used elsewhere but offered handicaps. If installed without ducts, as was done to cut cost, the results did not prove satisfactory. With proper distribution ducts, the first cost was rather high. Also, the number of motors with their controls, and the fans with their bearings, created a service problem.

As between radiators or convectors, the choice of the floor standing cast iron column type radiator was at the time (in the 1930's) based on lower cost and easy installation. The cost (as of today) of copper convectors having become less than cast iron radiators, figured on the square foot basis, the authority is presently trying out convectors.

Up to now, the specifications have called for four or five tube radiators on 4½ in. legs, 22 and 25 in. high. A great many rooms, after deduction for exposed piping, require only 14.4 and 16.0 sq ft EDR. This calls for an eight section radiator which is only 14 in. long. These have been found to be unsteady and too easily pulled out of place (either by riser expansion or by the tenants). Being installed before the finished floors are laid, the man laying the floor tiles had to jack the radiators up to get the tile under the legs. With 4½ in. legs, it was difficult at times to get the proper pitch for the return runout, even by running it in back of the radiator, without having the riser tee hit the floor. All this required very accurate roughing in, and coupled with the unavoidable variations in floor height in concrete frame buildings, risers could not be cut in the shop but had to be cut and threaded to fit in the field. All of these conditions, coupled with the lowering cost of convectors, led the authority to try the use of convectors.

The design is shown in an accompanying drawing. A basic idea influencing this design is to provide means for setting the convectors in permanent position before plastering so that they can be used for temporary heat without having to face the usual extra cost of temporary settings. This is done by nailing the back sheet to the brick wall, using wood shims as may be required to keep the face of this sheet flush with the plaster line. This sheet is made in two sections so that adjustment can be made to compensate for variations in floor to sill height. The cabinet may be attached or hung to this sheet in any approved manner. The heating elements are of the copper fin type with end connections. Return branches are run under the convectors which, being 16 in. high, give ample room for pitch.


Panel neatly finished at sill
Grounds to be shimmed with wood shims to provide a true surface of the panel flush with the finished plaster.
Back plate of convector assembly fastened to panel and to wood grounds.
Wood grounds
Convector cabinet
Panel fastened to wood grounds on four sides.
2"X1½" grounds fastened to back-up blocks.
Length of Convector Cabinet
Finish Floor
Panel neatly finished at floor.
ELEVATION
SECTION
Wood Shim
Wood Ground
Vary, (See arch. wall details.)
non-metallic panel Set flush with fin. plaster
Cabinet
PLAN
Convector Cabinet
SECTION
Panel to be shimmed to provide true surface flush with finished plaster.
18 ga. panel fastened to wall with nails. Panel in two sections.
Slotted holes in lower section to allow for adjustment.
Stiffener on units 36" long and longer
Nail Holes
Length of Convector Cabinet
ELEVATION
Vary- (See arch. wall details.)
Shims
Finished Plaster
Cabinet
PLAN

CONVECTOR installation details recently adopted by the housing authority. Method at left illustrates use of non-metallic panel adopted in light of possible steel shortages

Cabinets are 4 in. deep. Standard angle pattern valves and traps are used.

At the moment, due to possible scarcity of steel on account of increased armament requirements, contractors may propose to use non-metallic back sheets, such as asbestos-cement board, nailed to wood grounds of thickness as required to meet the plaster line.

### What Medium for Heating?

The 10 prewar jobs were, with the exception of a few buildings on one job, not over six stories high. In fact, two jobs were only two story, containing 76 buildings averaging 10 families per building—what are commonly called "garden apartments". Two other jobs were three and four story walkups and only five jobs were six story elevator apartments. In other words, this early construction comprised low buildings but the postwar projects have been predominantly six to 14 stories with one of them going up to 17.

Steam has been used as the heating medium for all projects regardless of height or topography. The choice of steam was made as a result of studies by the housing authority engineers and reports from several consulting engineers which indicated low first cost and ease of balancing, operating and maintaining as some of the advantages.

One pipe steam systems were discarded because of the difficulty of control, and because the higher fuel cost would rapidly eat up any possible saving in first cost.

The original decision was to use vacuum pumps because of the excellent circulation at all times, with fast elimination of air when heating up. Vacuum pumps also make it possible to take advantage of subatmospheric steam control which has been demonstrated on earlier federal housing jobs as being desirable.

Recent experience has indicated that with some types of control, condensate pumps might be used instead of vacuum pumps and the specifications are being revised to permit this change under certain restricted conditions.

### Exposed or Concealed Piping?

All buildings are fireproof construction, with masonry walls and solid concrete floor slabs 5 in. thick. Asphalt tiles are laid directly on these slabs. Plaster ceilings are not used, the slabs being painted instead. There is space in the floor construction for the electrical conduit only.

Concealing or furring in the risers and radiator branches would mean a substantial increase in cost for which there would be only one value—appearance. In view of the low rents, it is not considered logical to pay for this relatively minor improvement. So all piping is run exposed and this provides a saving not usually taken advantage of—the exposed piping is considered part of the heating surface which costs nothing and the radiators are reduced in size to make an additional saving.

Two concessions were made—more to utility in the saving of floor and wall space than to appearance. Both steam and return risers are in the same corner of the room and the radiators are centered under the windows. Thus, the radiator branches are on one side only, leaving the other side clear for furniture. This brought with it an interesting problem in expansion.

### How Expansion Is Handled

Ordinarily, a branch from a riser to a radiator works out to be at least 3 ft long and that is usually considered to be the minimum length to take up riser expansion. Bearing in mind that the rooms on these low rent jobs are not large, and that the radiators should be connected with top steam inlet and bottom outlet on the opposite end, it was found that in most cases it was not possible to use the ordinary length of runout. Tests made by the authority showed that a length of 21 in. from the center line of the riser to center line of the valve is satisfactory for riser expansion up to ¼ in. if three 90 deg elbows are used in the runout to get swing for expansion and pitch. In order to get room for the return runout, the radiators are set out from the wall so that the pipes can run behind them, requiring the use of corner pattern traps.

In six story buildings with the risers anchored in the middle, the riser expansion on the top and bottom floors is very small. But with heights of 10 to 17 stories, this minimum was found to be all right for two floors each side of the anchor but insufficient beyond that limit and very decidedly inadequate for the upper and lower floors.

Apparently it would be necessary to go to the extra cost of using expansion joints and more anchors. When applied to a single building this would be a trivial added cost but when applied to the many thousands of risers involved, this cost is an important item.

A study was made (this being one of the studies of minor items which can be made to pay big returns on large projects) to see how this expansion could be taken care of with less cost. It was found that a table could be prepared to show the proper minimum runout length in relation to expansion and the number of floors from the anchor. This table is as follows:

| Building floor | Minimum length, center of riser to center of trap or valve | |
|---|---|---|
| | Supply | Return |
| 14 | 4'8" | 4'4" |
| 13 | 4'0" | 3'8" |
| 12 | 3'4" | 3'0" |
| 11 | 2'8" | 2'4" |
| 10 | 2'0" | 1'8" |
| 9 | 1'9" | 1'5" |
| 8 | 1'9" | 1'5" |
| 7 | 1'9" | 1'5" |
| 6 | 1'9" | 1'5" |
| 5 | 1'9" | 1'5" |
| 4 | 2'0" | 1'8" |
| 3 | 2'8" | 2'4" |
| 2 | 3'4" | 3'0" |
| 1 | 4'0" | 3'4" |

The riser anchor is at the seventh floor level in a 14 story building and is made up by resting the flange of the tee used for the radiator branch on a heavy cast iron floor plate.

The top floor radiators are increased in size to take care of roof loss and are of such length that the required minimum runout length cannot be obtained in some of the taller buildings. To take care of this, the authority specifies that radiators have steam and return connections top and bottom at the end opposite the risers. Where such radiators are over 12 sections long, a copper distributing tube is used to insure the proper filling of the radiator. In some cases, six tube radiators are used to keep the number of sections below 12.

Thought was given to the value of connecting radiators in tandem; that is, using one pair of risers for two rooms adjacent to each other, thereby saving a great many risers. In fact, this was tried but the extra cost of fittings and labor to get around the columns ate up any saving, and the connections took up considerable floor space.

[A second article by Mr. Smith will cover heating system control in and design factors for New York City Housing Authority projects.]

## CONDITIONED AIR FOR AIRFARERS

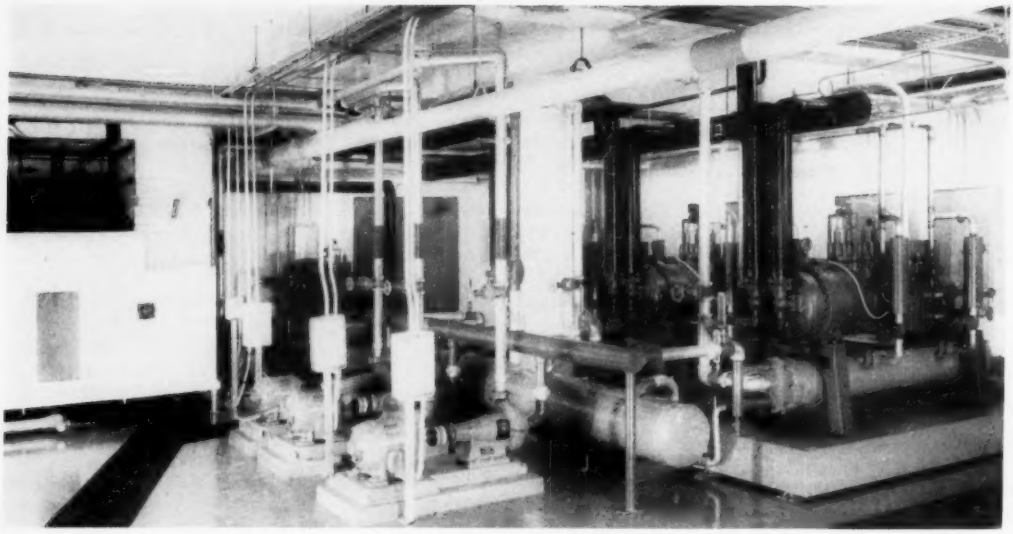
THE LARGEST mobile aircraft heating and air conditioning unit ever used by a commercial airline has been placed in operation by United Air Lines to further increase passenger comfort while planes are on the ground. Five units will be purchased by the airline and placed at key points on its 13,250 mile system, according to United.

With a cooling capacity of 28 tons, the conditioner also can be adapted with a heater to serve a dual purpose — heating cabin interiors in the wintertime as well as cooling them in summer. The heater has a capacity of 250,000 Btu.

Designed to cool 2000 cfm of air at normal operating speeds, the refrigeration unit brings cabin temperatures down to a comfortable level in less time than was previously required.

The complete unit, with hose attached, is mounted on a 1½ ton truck chassis. The specially designed body can be entirely removed in less than half an hour to facilitate interior equipment maintenance when necessary.

United Air Lines' ground equipment engineers, headed by M. B. Crawford of the company's San Francisco maintenance base, worked with the manufacturer in design and development of the equipment.



FLEXIBILITY results from three 40 hp compressors in parallel, each with 50 percent capacity reduction. One 25 hp unit in background serves separate office zone

# How Air Conditioning System Meets Church's Requirements

AIR CONDITIONING a church involves several general factors that must be considered carefully, such as the method of obtaining the minimum first cost consistent with low maintenance; provisions in the system design to facilitate ease of day-to-day operation, since operating personnel is often poorly trained; and architectural arrangement to simplify the problem of air conditioning, both in helping to keep down first cost and in facilitating daily operation of the system.

## Five Functional Zones

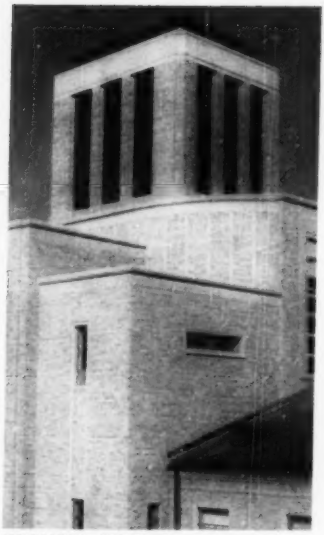
In the design of a typical church air conditioning job, the author gave careful consideration to each of these factors, and with the close cooperation of the architects, was able to specify a year 'round system which is unique in several respects and which has satisfactorily met the requirements.

The project was divided into five separate functional zones, the Sunday school, sanctuary, auditorium, social hall, and administrative space. An analysis was made to determine the maximum probable peak refrigeration loads that could simultaneously occur. Obviously, all of the spaces would never be used at the same time, and few would be used more than once or twice a week.

Only the administrative offices would be used daily. A system entirely separate from the others was installed for this zone because of its high load factor. The architects were able to arrange for certain small meeting rooms to be included in the administrative area zone so that they would be available for use at odd times during the week, without necessitating the operation of an additional system.

For most denominations, no two of the remaining four zones would ever be used simultaneously, except that a small Sunday school load might occur during church services. However, there could be a short overlap in operating time, such as when precooling the social hall for use immediately after church.

Based on the above analysis, the peak load was calculated to be approximately 115 tons, although the total of all zones, if they were used simultaneously, would be 300 tons.



COOLING TOWER enclosure is an architectural feature of the structure

**I. A. Naman, consulting engineer, tells here how the air conditioning design for a new church in Houston meets these requirements:**

**1) Minimum installed refrigeration with flexibility for use where required.**

**2) Centralized refrigeration plant with careful functional zoning.**

**3) Electrical and control arrangement for completely automatic year 'round operation by untrained personnel.**

**4) Minimum equipment noise level in the sanctuary.**

The key problem was to design a system having a total capacity of only 115 tons, and with sufficient flexibility to permit all or any part of this capacity to be used where needed.

### Cooling Flexibility the Key Problem

Several methods of obtaining the necessary flexibility were investigated. First, a system having only one air handling unit and with ductwork arranged for diversion of the cooled air was considered. This seemed impractical because the same system must be used for heating all zones simultaneously and, in addition, the load requirements for the zones all differ. Therefore, a separate air handling unit was used for each zone.

Second, a method of supplying refrigerant to each zone as needed had to be chosen, the choice being between direct expansion and circulating chilled water. A preliminary cost estimate showed that a direct expansion system would be lower in first cost than would chilled water. Since its efficiency is also higher than that of chilled water, a direct expansion system was selected. The long runs of refrigerant lines were carefully sized for low pressure drop. All joints were silver soldered by competent mechanics to avoid costly refrigerant leaks in the future.

The refrigeration plant was set up with three 40 hp compressors in parallel. Operation of the plant, from the standpoint of the custodian, is as follows:

A main control panel contains a rotary switch for each of the air handling units, a pneumatic switch to control the position of the outdoor air damper for each of these units, one cooling switch and one heating switch. To place the plant in operation, the operator turns on the switch for each air handling unit he wishes to use, and then the master cooling switch and the master heating switch.

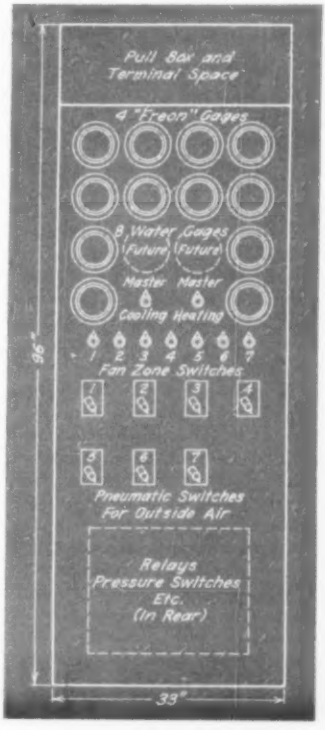
During the cooling-down period and before occupancy, outdoor air dampers are kept closed. When the time for occupancy arrives, the outdoor air dampers for the proper zones are opened by operating the corresponding pneumatic switch on the control panel and the entire plant is then in complete automatic operation.

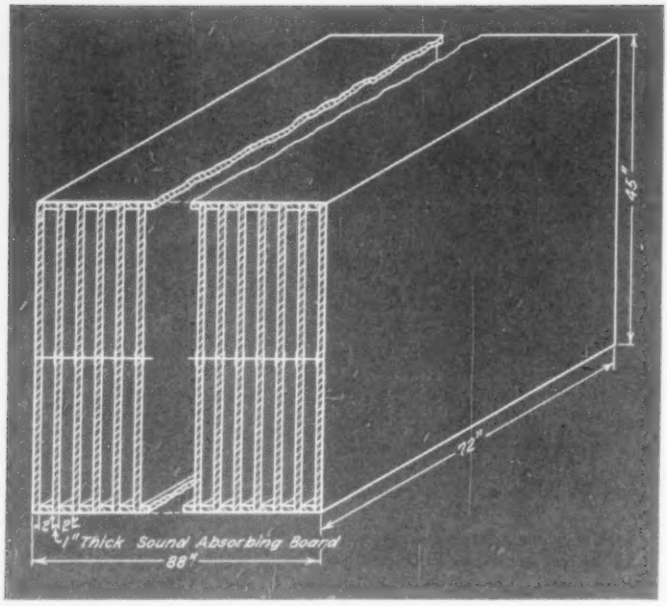
Cooling is provided in one zone if required, simultaneously with heating in another zone, and automatic change-over from heating to cooling, or vice versa, is provided as the load changes. In addition, reheat is put in operation automatically if required to maintain the proper relative humidity.

The compressors are controlled by a step controller actuated by refrigerant suction pressure so that only the refrigeration capacity needed will be in operation at any time. The compressors are each provided with 50 percent capacity reduction, which gives a total of six steps of control.

Since some of the air handling units are in the basement and others are in the second floor attic space, it was essential to provide compressor discharge pressure control in order to prevent the high units from being starved for refrigerant at certain times during periods of mild outside air temperatures when condenser water from the cooling tower would be relatively cold. This control was

CONTROL PANEL was made in accordance with diagram prepared by the consulting engineer






SOUND ABSORBING section for short return air duct runs connecting to the sanctuary has proved exceptionally effective. This one is designed to handle 14,000 cfm

accomplished by installing pressure-electric switches in the common compressor discharge line which will, on a drop in compressor discharge pressure, slow down the cooling tower fan to one-half speed. The reverse action will occur with a rise in pressure.

Turning on the master heating switch places the steam boiler in operation, along with associated auxiliaries. Steam is then available for space heating or reheat, as required. If desired, this switch may be left in the off position during the cooling season but the room temperatures will drop too low when reheat is required, unless the humidistats are manually reset.

The master cooling switch controls the operation of the refrigeration plant. With this switch energized, the cooling tower, condenser water pumps and compressors will operate, providing at least one zone fan is in operation and providing that zone requires refrigeration. If no refrigeration is required, the plant will automatically shut itself down. The step controller operates compressor and condenser water pump capacity as needed.

Each air handling unit is provided with automatic face and bypass dampers, a steam heating coil and a direct expansion cooling coil. The bypass is around the cooling coil only, with all air passing through the heating coil.

The above arrangement simplifies the temperature control system since there is no change-over required when switching from summer to winter operation, or vice versa.

In operation and starting with the system on the cooling cycle, as the load decreases the face dampers will modulate closed and the bypass will open. When the bypass is fully open, the liquid line solenoid valve for this unit will be closed automatically to shut off cooling. With a further drop in room temperature, the steam valve will begin to open to provide heat.

### Volume Damper Control For Classrooms

Pneumatic temperature controls are used throughout the installation, and the individual classrooms in the Sunday school have separate room volume damper control. This is important because the room occupancy varies greatly and, as a result, room temperature would vary also without the individual room controls. A double duct system could have been installed in lieu of this arrangement and would have the advantage of providing constant ventilation, but since these areas are used for such short periods of time, it was decided that the advantages of the more expensive double duct system would not offset its higher first cost.

The main control panel was manufactured in accordance with an electrical diagram prepared by the engineer and was furnished complete with all wiring to a numbered terminal strip, in order to simplify service work.

### Special Noise Precautions

Special precautions were taken to maintain a minimum equipment noise level in the sanctuary. This was successfully accomplished by choosing a quiet operating centrifugal fan, keeping the duct velocities low, proper choice of return air grilles and ceiling outlets and liberal use of sound absorbing material in the ducts.

The main supply duct was lined with sound absorbing material for a distance of about 50 ft. The fan plenum was also lined, and the return air ducts were protected with a sound trap. The latter was necessary because of the short return air duct runs connecting directly to the sanctuary. This sound trap has proved exceptionally effective.

To summarize, the design included features which are important to any church project:

Minimum installed refrigeration capacity with flexibility for use in any space where required.

An architectural design that permitted a centralized refrigeration plant with careful functional zoning.

An electrical and control arrangement that permits completely automatic year 'round operation by untrained personnel.

Careful design of the system serving the sanctuary to secure a minimum equipment noise level.

## BOILER SALES UP 66.4 PERCENT

Sales of cast iron boilers during the first six months of 1950 were 66.4 percent greater than sales during the corresponding period of 1949, according to the Institute of Boiler and Radiator Manufacturers.

# THE HEAT PUMP
# Heat Sources and Sinks

**Resulting from over two years of deliberation by a number of the prominent men active in the heat pump field, this discussion of the various heat sources—and sinks—is probably one of the most authoritative that is available anywhere**

IT HAS BEEN almost 100 years since Professor William Thomson (Lord Kelvin) first proposed the use of a compressor as a "warming engine" and as a means of heating buildings in place of the direct burning of fuels. Several early working models were constructed, but the device remained essentially of laboratory interest until the last 20 years.

The first actual residential heat pump installation was apparently made in Scotland in 1927. Both progress and growth of interest have been particularly rapid during the past three years in the United States, and at present there are several hundred residential installations and probably a greater number of commercial systems. However, much research is needed before the heat pump can compete economically and with equal reliability with more common forms of heating and fuels.

### Data Needed on Sources, Sinks

One of the major problems involves research on and the compilation of reliable design data for the various heat sources and sinks available. The four principal potential sources are air, water, earth and solar energy. The first three are primary sources of heat which may be used alone. The fourth, solar energy, while of tremendous potentiality, will probably be developed in most localities as auxiliary to the other three. In addition, there are other minor sources such as process waste heat, sewage, etc., which may be used under special circumstances. There are also a number of industrial applications of heat pumps for purposes other than space heating and which are practical largely through economic considerations of the particular process involved.

A committee was formed in January '48 to study heat sources and sinks applicable particularly to space heating. Early in the group's conferences, it was recognized that there was need for coordination and direction of the various heat source and heat sink researches, both in progress and in need of prosecution. As a result, the accompanying outline, prepared jointly by the committee, arranges in orderly fashion those problems most needing study and coordination.

Although there are many satisfactory heat pump installations in use, there are also probably an equal or greater number of unsatisfactory ones which have resulted from poor engineering judgment and insufficient design information. However, with careful development, the committee believes that the heat pump will in the future take its proper place as a soundly engineered and satisfactory heating device.

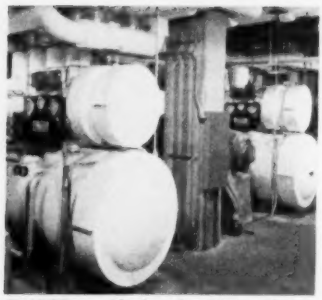
### Air as a Heat Source

Air offers many advantages as a heat source since it is universally present and is at favorable temperature levels during 75 to 95 percent of the heating season in most parts of the United States. Satisfactory design knowledge for its use is already available. Usually, the first cost of the heat source equipment is lower than for water or earth sources. Air systems permit the design of self-contained factory assembled and tested units. Air forms an inexhaustible heat source, automatically and promptly replenished, as well as an equally satisfactory heat sink when the application is reversed and the system is used for space cooling.

One of the serious limitations of air is that when the heating demands are highest, the air temperatures are lowest and the coefficient of performance is, therefore, reduced. In order to provide heat when air temperatures are below 35 to 37 F. with a unit size to meet normal requirements, either excess heat pump capacity must be provided to meet the heating requirements (and in some cases to allow time for defrosting heat source coils), there must be an alternate heat source, or standby heat must be available. The widely variable air temperatures to which this system is subjected introduce difficult control and frosting problems. Bulky heat exchanger equipment is usually required — unless reduced at the expense of large circulating power requirements. Unless the lo-

*This discussion and outline is the composite work of a committee under the chairmanship of R. C. Jordan, professor and acting head, mechanical engineering department, University of Minnesota.*

AIR is the heat source for this job



WATER provides heat for this installation

EARTH coils to serve a small heat pump

cation of the equipment is limited within a building, extensive ducting of the air may be necessary.

## Water as a Heat Source

Either city water, well water, surface water or waste water may be used as heat sources and sinks.

*City Water*

Although city water is readily available and requires no pumping, its cost usually makes it prohibitive and disposal problems and local use restrictions caused by water shortages are often met. The temperature variation is less than for air but differences of 15 to 25 F are frequently encountered and in many localities the temperatures are too near freezing to permit further heat removal. City water does, however, have the lowest first cost for source equipment, forms a good heat sink, and sufficient design information is usually available.

*Well Water*

Well water forms a very satisfactory heat source if the temperature is 45 F or higher and if the water is chemically suitable. The cost of producing the water is reasonably low, and once the well has been drilled and tested, the equipment required to use the water as a heat source can be calculated accurately. The heat transfer surfaces may be comparatively small and inexpensive.

However, in many localities the drilling of a well is a gamble with the location, temperature and characteristics of the water unknown until the final well has been drilled. The cost of drilling a well is substantial, and the water source may fail after a period of time. In some localities, disposal of the water may be difficult or impossible. In addition, the water may be corrosive or contain solids which will cause excessive scaling on the heat transfer surfaces.

*Surface Water*

Although surface water is rarely available, when it can be used it is tax free and operation and source equipment costs are relatively inexpensive. Surface water forms an equally good heat source or heat sink. Since surface water is economically available for only a very small percentage of the possible heat pump installations, its possible use it quite limited. In addition, corrosion, scaling and algae foulings are serious problems.

*Waste Water*

Waste water as a heat source for the heat pump is of such limited application and involves so many variable characteristics that it can be studied by the engineer only for a particular application. It is far from universal, is usually insufficient and is most likely to be corrosive and contain solids. It forms a good heat sink as well as a heat source. In many industrial applications, waste water is a logical source of heat, available in many cases at comparatively high temperatures. However, sewage and waste outflow are not reliable sources since the quantities involved are relatively small and the flow is inconsistent.

## Earth as a Heat Source

The earth as a heat source is widely available and usually has a smaller temperature change than does air. It forms a medium temperature source of heat in cold weather and is probably less expensive in equipment and installation costs than systems requiring drilling for well water.

However, heat pump systems using the earth as a source will normally be higher in cost than those using air, city water or surface water. The cost of installation of ground coils is high and frequently cannot be estimated accurately in advance. As yet, there is no adequate design theory which will enable proper calculation of equipment sizes. Excessive ground areas are required, and there may be damage to lawns and gardens.

The earth forms a poor heat sink. It is applicable only for small loads over a full heating season or for larger loads during a short period of time — possibly two weeks to a month. Its use may be limited by the depth of the frost line, the characteristics of the particular soil with regard to heat transmission and the climate, rainfall and topography.

## Solar Energy as a Heat Source

Whereas air, water and the earth constitute primary heat sources, solar energy must be considered as an auxiliary or secondary heat source unless used with an adequate storage system. The potentialities for utilization of solar energy as an auxiliary heat source for the heat pump are intriguing, since this is one of our largest untapped sources of energy. So little study, however, has been given to its use in conjunction with the heat pump that it is difficult to predict its probable status.

Although perhaps ideal as an auxiliary heat source, it does not form a heat sink. Since its availability is unpredictable except over fairly long periods of time, it will probably require a storage system. Satisfactory solar collectors have not as yet been developed, and since they probably will be bulky, their use may require architectural revisions.

### What Research is Needed?

The accompanying outline of research needed for the proper development of heat sources and sinks must be fixed within the matrix of the limitations and advantages here discussed. In addition, it should be recognized that heat storage devices may be used with any of these systems involving either a single or a dual heat source. One promising possibility involves the utilization of a storage pit or cistern operating upon a heat of fusion cycle supplied by supplementary heat from air or solar sources. Heat of fusion may also be utilized with, for example, city water and slush disposal to increase the practicability of that source.

The possibilities of heat storage are particularly applicable to heat taken from air or solar sources, but such devices are limited by the additional cost and space requirements. Combinations of heat sources — such as air and water, air and ground, air and solar energy or ground and solar energy — may result in improving the coefficient of performance over an entire heating season but will probably result in considerably greater initial cost of the system.

## RESEARCH OUTLINE—HEAT PUMP SOURCES AND SINKS

A — AIR AS HEAT SOURCE

1 — Typical Climatic Data for Winter and Summer (compile for regions with annual degree-days of 1000, 2500, 4000, 5500)

- 1.1 — Mean monthly temperature (dry bulb, wet bulb, dew point)
- 1.2 — Extreme monthly temperatures (dry bulb, wet bulb, dew point)
- 1.3 — Length of growing season (between killing frosts)
- 1.4 — Occurrence of fog and sleet

2 — Recommended Winter Outdoor Design Temperatures (dry bulb, wet bulb)

- 2.1 — Minimum recorded temperature for principal cities
- 2.2 — Spread between minimum and design temperature

3 — Daily Cyclic Temperature Variations (dry bulb, wet bulb, dew point, relative humidity)

- 3.1 — Daily spread between max. and min.
- 3.2 — Typical 24 hr chart

4 — Procedure for Coordinating Winter-Summer Coil Design Conditions

- 4.1 — Relative capacities for evaporator and condenser service
- 4.2 — Air quantities to be handled
- 4.3 — Refrigerant quantities required
- 4.4 — Effect of wet bulb temperature on coil capacity

5 — Factors Affecting Frost Formation and Accumulation*

- 5.1 — Coil temperature maintained
- 5.2 — Air temperature entering and leaving
- 5.3 — Water vapor content in entering air
- 5.4 — Fog or sleet in entering air
- 5.5 — Air velocity
- 5.6 — Dust and vapor pollution in air
- 5.7 — Arrangement of inlet louvers and screens

6 — Types and Properties of Frost

- 6.1 — Granular
- 6.2 — Hoar
- 6.3 — Ice film
- 6.4 — Density and porosity
- 6.5 — Thermal conductivity

7 — Effect of Frost Accumulation

- 7.1 — On air velocity and quantity
- 7.2 — On heat transfer coefficient for coil
- 7.3 — On heat pump capacity and coefficient of performance

8 — Type of Coils and Other Evaporator-Condenser Units

- 8.1 — Extended surface coils (finned)
- 8.2 — Plain tubes (100 percent primary surface)
- 8.3 — Shell and tube with air flow through tubes
- 8.4 — Cylindrical shells and flat surfaces (100 percent primary surface)
- 8.5 — Other

9 — Arrangement of Evaporator-Condenser Units

- 9.1 — Single section
- 9.2 — Multiple sections in parallel
- 9.3 — Multiple sections in series

10 — Finned Coil Design Features

- 10.1 — Tube rows in depth
- 10.2 — Tube arrangement and spacing
- 10.3 — Fin size and metal thickness
- 10.4 — Fin spacing and shape
- 10.5 — Fin stagger and angular position
- 10.6 — Refrigerant manifolding for uniform temperature
- 10.7 — Refrigerant manifolding for seasonal reversal of coil functions

11 — Detection of Frosting and Automatic Operation of Defrost

- 11.1 — By temperature changes of air
- 11.2 — By changes in superheat of refrigerant
- 11.3 — By air resistance changes
- 11.4 — Other

12 — Methods for Prevention of Frost Formation*

- 12.1 — Air velocity giving blast or scouring effect
- 12.2 — Air filters for dust removal
- 12.3 — Temperature differential between air and coil surface

13 — Methods of Defrosting

- 13.1 — Air flow cut-off or reversal
- 13.2 — Hot gas defrost cycle
- 13.3 — Refrigerant circuit changeover
- 13.4 — Water spray
- 13.5 — Antifreeze solution film
- 13.6 — Electric resistance heating units
- 13.7 — Mechanical devices
- 13.8 — Other

14 — Application of Evaporative Condensers and Cooling Towers for Heat Pickup

- 14.1 — Analysis of designs commercially available
- 14.2 — Modifications required from standard
- 14.3 — Choice of antifreeze solutions
- 14.4 — Heat pickup capacity obtained
- 14.5 — Effect of antifreeze on summer heat dissipation
- 14.6 — Cost comparison with dry coil type

B — WATER AS A HEAT SOURCE

1 — City Water — (a) River Source, (b) Lake Source, (c) Underground Source

- 1.1 — Temperatures, maximum and minimum
- 1.2 — Time of maximum and minimum temperatures
- 1.3 — Quality: hardness, other solids, organic material, pH value
- 1.4 — Availability: shortages, restrictions
- 1.5 — Cost

2 — Well Water

- 2.1 — Temperatures, maximum and minimum
- 2.2 — Time of maximum and minimum temperatures
- 2.3 — Depth of water bearing strata
- 2.4 — Quality: hardness, solids, dissolved gases, sulphur, pH
- 2.5 — Quantity vs. casing size and "pull down"

2.6 — Drilling methods, costs and geological data
2.7 — Lateral flow in water tables
2.8 — Thermal wells

3 — Surface Water

3.1 — Rivers and streams

3.11 — Temperatures, maximum and minimum
3.12 — Time of maximum and minimum temperatures
3.13 — Quality: hardness, other solids, organic material, industrial wastes, pH value

3.2 — Lakes

3.21 — Temperatures, maximum and minimum
3.22 — Time of maximum and minimum temperatures
3.23 — Vertical temperature gradients in deep lakes, variation with wind
3.24 — Quality: hardness, other solids, organic material, pH value

4 — Waste Water

4.1 — Industrial plants
4.2 — Power plants
4.3 — Distribution economics
4.4 — Sewage

5 — Water Disposal

5.1 — Use of sanitary and storm sewers
5.2 — Design of shallow dry wells
5.3 — Slush disposal possibilities
5.4 — Effects of disposal wells on supply wells
5.5 — Restrictive ordinances affecting disposal

6 — Water Source Auxiliaries

6.1 — Pumps: well and other
6.2 — Strainers and sand traps
6.3 — Water treatment
6.4 — Antifreeze devices
6.5 — Alternate source switchover control
6.6 — Submerged heat exchanger design

C — EARTH AS A HEAT SOURCE

1 — Geological Strata:

1.1 — Data to be obtained
1.11 — General characteristics
1.12 — Mechanical analysis
1.13 — Density, dry and wet basis
1.14 — Thermal resistivity (conductivity)
1.15 — Effect of moisture migration
1.16 — Thermal diffusivity
1.17 — Specific heat
1.18 — Electrical resistivity
1.19 — Effect of freezing and thawing on 1.14 and 1.15
1.110 — pH value
1.111 — Latent heat

1.2 — Soil identification according to Casagrande (Army Airfield) classification system*

1.21 — Gravel and gravelly soils
1.22 — Sands and sandy soils
1.23 — Fine grained soils having low to medium compressibility
1.24 — Fine grained soils having high compressibility
1.25 — Fibrous organic soils with very high compressibility
1.26 — Further classification into 15 groups established under the above five major divisions of Casagrande system

1.3 — Soil sampling and testing methods

1.31 — Size of samples needed
1.32 — Sampling methods for undisturbed soil
1.33 — Field tests for identification
1.34 — Laboratory test procedures
1.35 — Moisture determination in place

1.4 — Classification systems

1.41 — Comparison of recognized systems
1.42 — System preferred for heat-pump work

2 — Groundwater Occurrence*

2.1 — Height of water table
2.11 — Normal
2.12 — Seasonal fluctuations
2.13 — Long term trend

2.2 — Rate of subsidence after rain or water injection
2.3 — Natural water circulation or movement, horizontally and vertically
2.4 — Water content or percentage saturation of earth

3 — Natural Vertical Temperature Gradient in Earth at Selected Geographic Locations

3.1 — In winter months

3.11 — Data to be obtained for kinds of earth listed under 1.2
3.12 — Effect of water content on depth-temperature relation

3.2 — Same for summer months

4 — Natural Cyclic Temperature Variations of Earth

4.1 — Depths
4.2 — Daily cycles
4.3 — Periodic (between successive cold or hot spells)
4.4 — Seasonal (cumulative effect)
4.5 — Yearly (influence of seasonal reversal)
4.6 — Long term

5 — Factors Affecting Earth Temperature and Cyclic Variation*

5.1 — Ambient air temperature, determining conduction and convection
5.2 — Solar heat absorption
5.3 — Radiation
5.31 — Clear sky
5.32 — Cloudy sky
5.33 — Day and night values

5.4 — Precipitation
5.41 — Rain
5.42 — Dew
5.43 — Snow

5.5 — Evaporation
5.6 — Wind
5.7 — Conduction from and to substrata

6 — Effect of Top Surface*

6.1 — On solar and other heat absorption (see section D)
6.2 — On radiation and other heat dissipation (see section D)

7 — Relative Effect of Heat Input and Withdrawal on Earth Temperature and Gradients*

7.1 — Heat input tests translated by calculation for heat withdrawal vs. separate tests for determining heat "reservoir" capacity and temperature gradients
7.2 — Influence on vegetation

7.21 — Lawns, shrubbery, gardens
7.22 — Trees, other deep rooted plants
7.23 — Retarding or winter killing
7.24 — Stimulating or summer parching
7.25 — Effect on insects, parasites, micro-organisms in soil and on vegetation

8 — Temperature Gradient in Earth with Operation of Heat Pump

8.1 — Both vertically and horizontally as affected by

8.11 — Location, arrangement and size of heat pick-up device
8.12 — Rate of heat withdrawal or input by heat pump
8.13 — Total cumulative heat withdrawal and input for heating and cooling seasons
8.14 — Kind of soil
8.15 — Water table elevation
8.16 — Water content of stratum
8.17 — Top surface conditions

8.2 — Depth and extent of frost penetration as affecting forces on and movement of undergound structures.

9 — Material for Backfill in Holes or Trenches

9.1 — Soil removed from excavation

9.2 — Other soil selected for conductivity
9.3 — Metallic admixtures
9.4 — Concrete, bitumastic compounds, etc.
9.5 — Methods for obtaining high thermal conductivity

9.51 — Puddling with water
9.52 — Tamping by hand tools
9.53 — Compacting by vibrators
9.54 — Impacting devices applied on pipes

10 — Provision for Maintaining High Thermal Conductivity in Earth

10.1 — Water application on surface or in open trenches
10.2 — Water injection pipes buried in earth
10.3 — Other methods proposed

11 — Heat Pickup and Disposal Pipes and Devices Installed in Earth

11.1 — Type of application

11.11 — For indirect heat transfer fluid circulation
11.12 — For direct refrigerant use (winter service as evaporator, summer service as condenser)

11.2 — Kind of device
11.21 — Plain pipe or tube
11.22 — Serpentine pattern tube
11.23 — Concentric tubes
11.24 — Flat plate

11.3 — Position of device

11.31 — Vertical
11.32 — Horizontal
11.33 — Inclined, looped, etc.

11.4 — Methods for improving heat transfer between earth and metal

11.41 — Fins, ribs, webs, collars, studs, etc. on exterior of tubes
11.42 — Other methods supplementary to subdivisions 9 and 10 above

12 — Possibility of Using Earth for Thermal Storage with Heat Pump Units

12.1 — To utilize surplus heat obtainable from heat pump, at times when capacity exceeds instantaneous requirement
12.2 — To utilize offpeak energy in direct resistance heating elements

D — SOLAR ENERGY AS HEAT SOURCE

1 — General*

1.1 — Relative merits of direct solar heating and cooling vs. solar heat as a heat source for the heat pump
1.11 — First cost
1.12 — Operation cost
1.13 — Reliability
1.14 — Noise
1.15 — Effect on building construction and costs
1.16 — Conservation of national resources
1.2 — Solar heat as auxiliary vs. natural primary heat source
1.21 — Auxiliary to air, water or earth
1.22 — Primary heat source

1.221 — Types of auxiliary heat

2 — Availability of Solar Energy

2.1 — Variations in incident total radiation received
2.11 — Daily
2.12 — Weekly
2.13 — Seasonally
2.14 — Yearly

2.2 — Recommended design values for incident solar energy at representative localities

2.21 — Geographical variations
2.22 — Seasonal variations

2.3 — Degree to which incident radiation is below recommended design values

2.31 — Maximum number of consecutive days
2.32 — Amount of thermal deficit

2.4 — Geographical areas with sufficient solar energy for heat pump operation

2.41 — As a primary heat source
2.42 — As an auxiliary heat source

3 — Solar Radiation Absorbers

3.1 — Definition and characteristics of an ideal absorber
3.2 — Description and performance characteristics of successfully used solar absorbers

3.21 — Plates
3.22 — Tubing
3.23 — Irregular surfaces
3.24 — Filled translucent blocks
3.25 — Mirror type devices

3.251 — Plane
3.252 — Parabolic
3.253 — Other

3.26 — Earth
3.261 — Untreated
3.262 — Treated

3.27 — Other

3.3 — Treatment of absorbing device or media

3.31 — Surface treatment
3.32 — Treatment of mass or aggregate

3.4 — Placement of solar absorber

3.41 — Location relative to building
3.42 — Orientation
3.43 — Angle of elevation

4 — Heat Pump Pickup Devices

4.1 — Application

4.11 — Use in combination with solar radiation absorber
4.12 — Use in connection with collecting device or medium
4.13 — Use in connection with storage

4.2 — Kind and design of device

5 — Solar Energy Storage

5.1 — Ideal storage media
5.11 — Chemical properties
5.12 — Physical properties

5.2 — Existing storage media and properties

5.21 — Liquids

5.211 — Water
5.212 — Other

5.22 — Chemical compounds with phase change

5.221 — Change of phase between 30 and 60 F
5.222 — Change of phase at temperatures greater than 60 F

5.23 — Solids

5.231 — Crushed aggregates
5.232 — Earth
5.233 — Other

5.3 — Location of storage: basement, attic, other
5.4 — Purpose of storage

5.41 — Storage of heat after delivery from heat pump
5.42 — Storage of solar energy heat before delivery to heat pump

*A poll of committee members indicated that the areas most needing research activity involved (a) methods for prevention of and factors affecting formation of frost on air coils (A5, A12) and (b) general study of potentialities of solar energy as a heat source for the heat pump (D-11. Considered to be next in importance were soil identification, groundwater occurrence, effect of soil top surface, and the factors affecting earth temperature and its cyclic variations (C1.2, C2, C5, C6, C7). This is in agreement with the consensus of the committee since its inception, for at the organization meeting of this group it was decided that the preferential order for *research activity* (but not necessarily the preferential order of importance as a heat source) was (1) air, (2) solar energy, (3) earth, (4) water.

SHOWROOM ceiling is false to form a chamber for heated air. This makes it a radiant heating panel. Grilles in rear wall are for return air

SLOT around perimeter of false ceiling, through which warm air is forced to sweep over the windows, prevents them from fogging and counteracts heat loss

# Radiant and Convected Warm Air Heat Meet Auto Showroom Needs

**Frank S. Lappin, midwestern district manager of the Dravo Corp. heating department, describes unique system combining warm air radiant and convection heating for a new automobile showroom and garage. Air discharged from a slot over the windows solves the problem of condensation fogging**

SOMETHING new in heating for automobile showrooms and garages is employed at the Edwards Motor Co., Milwaukee, large Dodge-Plymouth dealer.

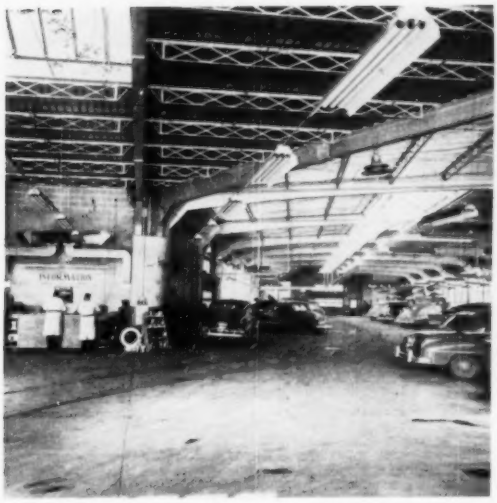
This unique system combines the use of warm air radiant heating with a direct fired convection method to achieve comfort for employees and customers and prevent display windows from fogging during cold weather. It was comparatively inexpensive to install and is simple to maintain and operate.

The entire ceiling of the showroom, part of the company's new east side branch sales and service building, was constructed to form, in effect, a chamber for heated air. Around the perimeter of the ceiling a 1½ in. wide slot was cut. Warm air sweeps down from the slot and wipes the large showroom window. This has a double effect of minimizing moisture condensation on the glass and counteracting heat losses. The windows stay clear during the coldest weather.

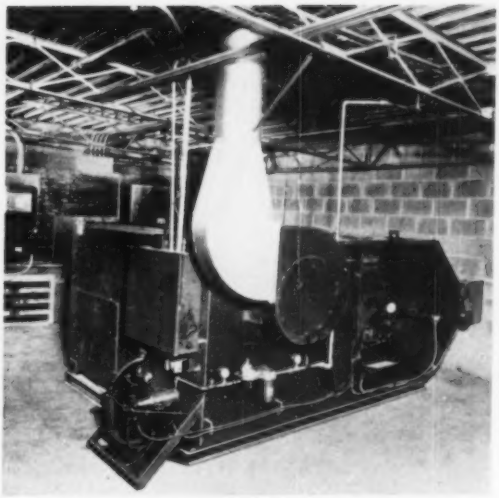
### One Heater Serves Showroom

One direct fired heater—fired with oil—takes care of the heating requirements for the entire showroom. It has an output of 750,000 Btu per hr, is located in a small room above the employee locker room in the service area of the building.

Warm air is forced from the heater through a large sheet metal duct and into the space between the false ceiling and the roof of the showroom. As this space is constantly occupied by warm air, the ceiling itself becomes a low temperature radiant heating panel. Banks of fluorescent lights recessed in the ceiling also add heat to the room. About 8500 cfm of warm air is forced by the heater into the ceiling



REPAIR and service shop. In rear, warm air is directed at the doorway to keep out cold air. Warm air is also blasted on autos to melt snow and ice



OIL FIRED heaters—four of them—are used. To save space, this one was installed horizontally, no modification, other than relocating control panel, being needed

area. The radiant heat of the ceiling keeps the terrazzo floor of the room pleasantly warm. The display area of the showroom contains 2512 sq ft of space while partitioned offices occupy another 1000 sq ft.

Air from the showroom is returned to the heater through another duct led from three grilled wall openings 8 ft above the floor. Recirculation of air in this manner helps conserve fuel. Through a louvered opening in the heater room wall, outdoor air can be brought in, heated and fed to the showroom to provide ventilation. The heater has controls that modulate the intensity of the flame according to the demand of a thermostat in the discharge air stream.

### Three Units Heat Service Garage

Three direct fired heaters, each with a capacity of 1,500,000 Btu per hr, are used to heat the service garage, which has a floor area of approximately 15,800 sq ft. These heaters, also located in separate rooms cut off from the main portion of the structure, operate either on recirculated air, outdoor air or a combination of both.

In Wisconsin, building codes require that automobile garages be ventilated by the introduction of 1½ cfm of fresh air for every square foot of floor area. Combined, the three heaters can handle a total of 51,000 cfm of air. Gravity vents, with openings 18 in. above the floor, exhaust foul air from the garage.

One of the three heaters discharges warm air directly into the service area through its four nozzles. Two of the nozzles are aimed at the 12 ft by 9 ft entrance doorway and, according to company officials, virtually block with warm air the entry of cold air when the doors are opened.

Another heater is arranged to perform several important functions. From one of its discharge nozzles, a duct is directed toward a wheel alignment pit 3 ft deep. The service superintendent's office is heated through another nozzle, a third one blasts warm air along the continuous steel sash windows and the fourth forces air diagonally across the building to an area where snow or ice covered cars are parked for thawing before being serviced. Personnel of the garage report that snow and ice are melted off cars with considerable speed by the warm air.

Described as one of the most modern service garages in the country, the new Edwards branch is one of four service centers operated in Milwaukee by the company. In the garage, each of 11 mechanic stations has its own lift and is flooded with light from six four-tube fluorescent fixtures. There are 14 other repair stations, as well as a wash rack and other modern service garage equipment. The walls are virtually all continuous steel sash and shadows seldom block clear view of the work being done. The roof is supported by cantilever beams and steel joists, eliminating the need for obstructing columns in the working area.

The building and heating system were designed by V. K. Boynton, consulting engineer. Paul J. Grunau Co. installed the heating system, which was supplied through the Rolloff Engineering Co.

### "BIG TRUTH" COMBATS "BIG LIE"

THE STORY of American industrial developments is the "Big Truth" that can combat the "Big Lie" that is being "spread with such sinister force throughout the world," Crawford H. Greenewalt, president of the Du Pont Company, said last month in a speech prepared for delivery to a meeting of the people of Camden, S. C., after dedicating Du Pont's new $20 million plant there.

"Historically, communism has never yet made inroads in nations which enjoyed a free, dynamic, expanding economy," Mr. Greenewalt said. "It has never failed to make gains in nations where the economy was static or sick."

# Methods of Making PIPING FLEXIBILITY Analyses

**Theodore E. Bridge Continues Explanation of Figuring Piping Flexibility By Scheme Which Has Been Found Useful by Himself and Others**

C. T. MITCHELL presented a graphical method of calculating the function $M$ in equations 10 and 11, as given on page 97 of the October HPAC, and he called this function, "the moment area of the system". With his method, the entire piping system is broken up into a number of straight pieces of pipe. The moment area $M$ of each piece of pipe is calculated separately and the results are totaled to give the combined moment area for the system as a whole.

### Calculating the Moment Area

It is proposed later to set up a tabular method of calculating the moment area $M$ and in this tabulation a formula is needed to calculate the moment area of a straight piece of pipe inclined at an angle with the thrust axis. Such a piece of straight pipe is shown in Fig. 6. One end of the pipe is located $Ya$ distant from the thrust axis and the other end is located $Yb$ distant. The length of the pipe is $L^*$. The problem is to develop an analytical expression for $(M = \int Y^2 dL)$, for this particular piece of pipe. From similar triangles,

$$L = L^* (Y - Ya) / (Yb - Ya) \quad \ldots\ldots[12]$$

This equation may be differentiated to obtain,

$$dL = L^* dY / (Yb - Ya) \quad \ldots\ldots[13]$$

Substitute [13] in [11]: $M = [L^* / (Yb - Ya)] \int Y^2 dY$, and integrating, $M = [Y^3 L^* / 3(Yb - Ya)]$. Between the limits of $Y = Yb$ and $Y = Ya$, $M = (Yb^3 - Ya^3) L^* / 3(Yb - Ya)$ or

$$M = (Y^3)^* L^* / 3 Y^* \quad \ldots\ldots[14]$$

Note that $(Y^3)^*$ is equal to the difference between successive values of $Y^3$. [It is not equal to the cube of $()^*$.]

When $Yb = Ya$, equation 14 is indeterminate but it is obvious that, under these conditions,

$$M = Y^2 L^* \quad \ldots\ldots[15]$$

In solving actual examples at the end of this article, a calculation sheet will be set up in which equations 14 and 15 will be used to determine the moment area of each section of the piping system. The total moment area so obtained will be used to determine the thrust $F$. After the thrust $F$ is determined, the following equation (derived from the familiar formula giving stress in a beam) will be used to calculate the stress:

$$S = 6 F Y_{max} D'' / I \quad \ldots\ldots[16]$$

### Two Assumptions Must Be Made

So far in the development of the theory, no important assumptions have been made. It is, however, necessary to make two assumptions when it comes to locating the thrust axis. All of the more accurate calculating methods described in the literature run into very serious complications in their attempts to locate the thrust axis with precision. It can, however, be demonstrated that a considerable error in locating the thrust axis makes only a negligible error in the answer, and it is therefore proposed that an empirical method be used in locating the thrust axis.

To prove this point, consider a condition where the thrust axis is

*Mr. Bridge acquired a wide experience in the design of power and process piping during 15 years with E. I. du Pont de Nemours & Co., and has also had experience in the field of very high pressures. At the time he prepared this article, he was a mechanical engineer with the University of Chicago in connection with a project under construction for the Argonne National Laboratory; he is now associated with Tube Turns, Inc. He has taught several other engineers to use the method described here in figuring flexibility of piping systems, and they have found it as useful as has he*

located a little away from its true position. The moment area $M$ calculated for the pipe on one side of the axis will be greater than it should be but the moment area calculated for the pipe on the other side of the axis will be almost the same amount less than it should be. It is true that the error is not on the safe side, but it is a small error. Thus it is seen that an appreciable error made in locating the thrust axis makes only a negligible error in the calculated result.

Mitchell made the following two assumptions in locating the thrust axis. First, he assumed that the anchors were perfectly rigid. This means that the thrust axis must be located in a position which will produce no angular displacement of the rigid arm when the force $F$ is applied as shown in Fig. 3, on page 96 of the October HPAC. In order to calculate the angular displacement of the rigid arm, equation 3 (page 96, October HPAC) may be integrated to give the following:

$$B = (144\ F/E\ I) \int Y\ dL \ldots\ldots [17]$$

where $B$ is the angular displacement of the rigid arm.

Mitchell always located the thrust axis through the center of gravity of the system and by definition of center of gravity this makes $\int Y\ dL = 0$. When this integral is made equal to zero, it will be seen from equation 17 that the angle $B$ must also be equal to zero. Thus it is seen that the assumption of rigid anchors determines that the thrust axis must pass through the center of gravity of the piping system.

The second assumption made by Mitchell will often introduce a serious error. This will be analyzed in the paragraphs which follow. Mitchell instructs the calculator to draw the thrust axis through the center of gravity of the piping and also to orient the axis parallel to the direction in which the expansion takes place — that is, parallel to a line drawn between the anchors. It was demonstrated in the preceding paragraph that it should be drawn through the center of gravity, but it will be shown in the following paragraphs that it should not necessarily be drawn parallel to the direction in which the pipe expands.

The present author proposes that the thrust axis be located in an empirical manner, which greatly reduces the maximum possible error that is introduced when using the Mitchell assumption. At the same time, considerable savings in calculating time are realized by locating the axis empirically rather than exactly.

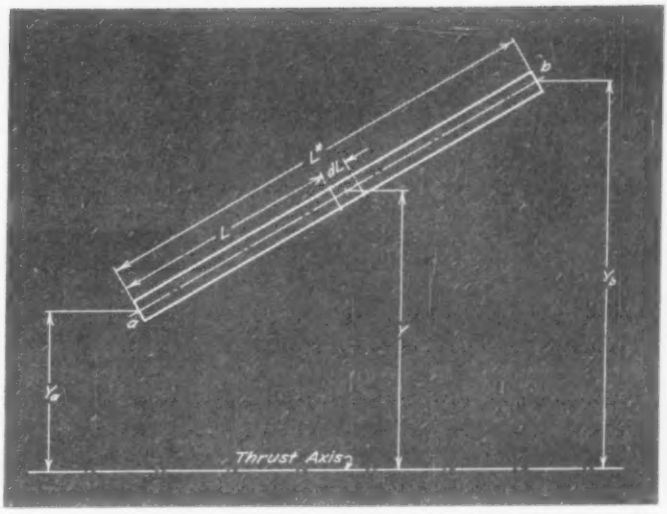



FIG. 6—A straight piece of pipe inclined at an angle with the thrust axis

By referring to Figs. 3 and 4 (page 96, October issue) it will be noted that the right hand anchor has been replaced by a rigid arm. It has already been shown that if the thrust axis passes through the center of gravity of the piping there will be no angular displacement of the rigid arm, and hence the assumption of rigid anchors is fulfilled.

## Symbols

$B$ is the angular displacement of the rigid arm under the action of the force $F$, radians.

$C$ is the angle between the thrust axis and a line joining the anchors.

$C'$ is an angle defined by the equation, $\tan C' = Z'/Z$.

$D''$ is the outside diameter of the pipe, in.

$dL$ is the length of a very short element of pipe, ft.

$e$ is the coefficient of expansion of the material of which the pipe is made. (For steel, $e = 0.00000625$ per F).

$E$ is the modulus of elasticity of the material in the pipe, psi. For steel, $E = 29{,}000{,}000$ psi. This value decreases as the temperature rises, but the value for $e$ increases with rise in temperature. These two terms are always multiplied together, so that no correction for changes in temperature need be made for steel for all temperatures below 600 F.

$F$ is the force applied to the rigid arm to simulate the effect of anchoring the pipe.

$I$ is the moment of inertia of the pipe cross-section, in.$^4$

$L$ is the length from one end of a straight section of pipe to the element of pipe $dL$, ft.

$L''$ is the true distance between the anchors, ft.

$L^*$ is the length of straight pipe between two reference points, ft.

$M$ is the moment area, ft.$^3$ $M = \int Y^2\ dL$.

$S$ is the maximum bending stress in the pipe caused by thermal expansion.

$T$ is the difference between the operating temperature and the temperature at which the pipe is installed, degrees Fahrenheit.

$X$ is the distance from the rigid arm to the element of pipe $dL$ measured along the thrust axis, ft.

$Y$ is the perpendicular distance from the element of pipe $dL$ to the thrust axis, ft.

$Yb$ is the distance from the center of gravity of a pipe bend to the thrust axis.

$Y^*$ is the arithmetic difference between two successive values of $Y$. It is always taken as plus.

$(Y^3)^*$ is the difference between the cubes of successive values of $Y$. Note that it is not the cube of the difference.

$Z$ is the deflection of the rigid arm parallel to thrust axis, in.

$Z'$ is the deflection of the rigid arm measured perpendicular to the thrust axis, in.

$Z''$ is the vector sum of $Z$ and $Z'$, in. When the thrust axis is correctly located, it is equal to the expansion of the pipe.

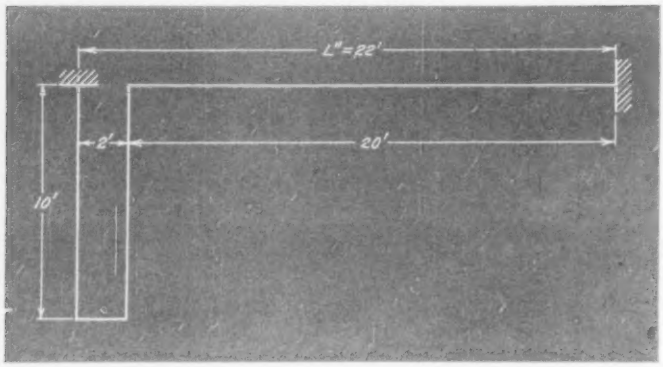



FIG. 7—Mitchell's method will result in error when used to solve this type of problem. Pipe is 3 in. diameter, schedule 40, $D''$ is 3.5 in., $I$ is 3 in.$^4$, and $T$ is 400 F

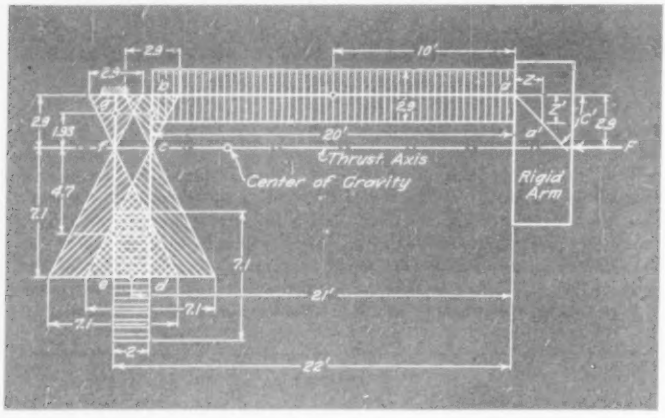



FIG. 8—This shows the use of Mitchell's method to solve the problem shown in Fig. 7

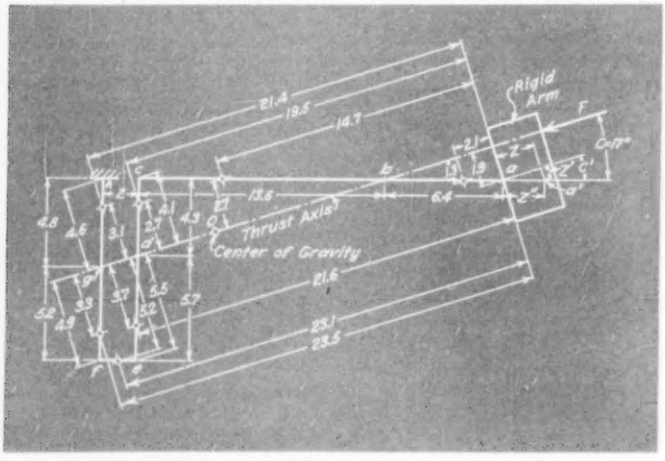



FIG. 9—The problem shown in Fig. 7 is solved here with the thrust axis located correctly

There is still another condition which must be fulfilled, in that there must be no sidewise movement of the rigid arm as the force $F$ is applied. It is this condition which makes it possible to choose the proper orientation for the thrust axis, as will be further discussed in the following.

It is always assumed that deflections are very small compared to the dimensions of the piping. The piping is shown in Figs. 3 and 4 in its position after application of the force $F$. It will be assumed that, on removing the force $F$, the point $a$ on the rigid arm will spring back to point $a'$. $Z$ is the component of the deflection parallel to the thrust axis, and $Z'$ is the component perpendicular to the thrust axis.

It can be demonstrated by referring to Figs. 3 and 4 that the sidewise deflection $Z'$ may be calculated from the following equations:

$$Z' = 1728\ F\ M' / E\ I \quad \ldots\ldots [18]$$

$$M' = \int X\ Y\ dL \quad \ldots\ldots [19]$$

$M'$ is a new function called the product moment area. $X$ is the distance from the element of pipe $dL$ to the rigid arm measured along the thrust axis. $Y$, as before, is the perpendicular distance to the thrust axis. By definition, the angle $C'$ is determined from the following formula.

$$\tan C' = Z' / Z = M' / M \quad \ldots\ldots [20]$$

$C'$ is the angle between the thrust axis and the direction in which the rigid arm moves as shown in Figs. 3 and 4. $C$, in the following equation, is the angle between the thrust axis and a straight line connecting the anchors. In other words, it is the angle between the assumed thrust axis and Mitchell's axis. In a sense, it is a measure of the error made by the Mitchell assumption. For special reasons, the thrust axis in Figs. 3 and 4 is not shown in its correct location. If it were, angle $C$ would equal angle $C'$ and the following equation would apply:

$$Z = Z'' \cos C \quad \ldots\ldots [21]$$

$Z''$ is equal to the amount that the pipe expands and is determined from the coefficient of expansion of the pipe.

$$Z'' = 12\ e\ T\ L'' \quad \ldots\ldots [22]$$

[21] may be substituted into equa-

tion 10 to obtain:

$$F = \cos C\ Z''\ E\ I\ /\ 1728\ M \ldots . [23]$$

The problem is to choose an orientation for the thrust axis that will produce a motion of the rigid arm from point $a'$ on Fig. 9 to point $a$, as the force $F$ is applied. In this way, the reactions produced as the pipe expands are duplicated. In other words, the deflection of the rigid arm must be in the direction in which the pipe expands. This means that, if the thrust axis is correctly oriented, angle $C$ will equal angle $C'$. Thus it is possible to determine the proper orientation of the thrust axis as follows. The angle $C$ is assumed at the start of the calculation. From this assumption, it is possible to calculate angle $C'$. By cut and try, it is finally possible to find the correct angle $C$, as was done in Fig. 9. An empirical method of locating the thrust axis with reasonable accuracy will be given later, making it unnecessary to resort to cut and try methods when solving actual problems.

It is believed that Mitchell made a very practical and workable simplification in locating the thrust axis as he did parallel to a line drawn between the anchors; but it is profitable to consider this further to make such corrections as might be practical.

### Solution of Problem Shows Maximum Error

In order to estimate the magnitude of the maximum probable error from employing the Mitchell assumption, the problem shown in Fig. 7 is solved in Fig. 8 using the Mitchell method. In Fig. 9, the same problem is solved with the thrust axis correctly oriented.

The results are then easily compared. It must be realized that the particular problem selected for this illustration was chosen to give the largest error that might be expected from using the Mitchell assumption. In problems where the piping is more symmetrically arranged, the error from using the Mitchell assumption would be much smaller. The object of this calculation is not to demonstrate how to calculate such a problem. It is rather intended to show how great a discrepancy might be encountered in using the Mitchell assumption under the most unfavorable circumstances. Rules will be laid down later for empirically locating the thrust axis in such a fashion that the error may be minimized.

It is proposed to calculate in Fig. 8 the moment area of the piping system exactly as Mitchell recommends. The thrust axis is first drawn through the center of gravity of the piping and also parallel to a straight line between anchors. To aid in visualizing the flexing of the pipe, the right hand anchor is replaced with an imaginary rigid arm, and the force $F$ is applied as shown at the thrust axis.

As directed by Mitchell, shaded areas are constructed on the figure in which the areas are proportional to $(\int Y\ dL)$. To obtain the moment area $(M = \int Y^2\ dL)$ the area of each shaded portion is multiplied by the length $Y'$, the perpendicular distance from its center of gravity to the thrust axis. This product is called the moment area $M$ and is used in equation 23 to calculate the force $F$. Mitchell assumes the thrust axis parallel to a line between anchors which is equivalent to assuming $C = 0$; therefore, $\cos C = 1$.

The present author is introducing a new function called $M'$, the product moment area. This function is calculated for the sole purpose of testing the validity of Mitchell's assumption. The product moment area $M'$ is obtained by multiplying the area of each shaded portion by $X'$, the distance from the center of gravity of the shaded area to the rigid arm measured along the thrust axis. The function $M'$ is used in equation 18 to calculate the deflection $Z'$. Equation 20 is then used to calculate angle $C'$, which should equal zero if the Mitchell assumption is valid.

Refer to Fig. 8, in which the flexibility of the piping shown in Fig. 7 is calculated using Mitchell's method. When using the Mitchell method, it is assumed that angle $C = 0$. The data in the following table are taken from the figure:

| | Area = $A$ | Arm $Y$ | Arm $X$ | Moment Area $M$ | Moment Area $M'$ |
|---|---|---|---|---|---|
| a | 20 × 2.9 = 58 | 2.9 | 10 | 168 | 580 |
| b | 2.9 × 2.9 / 2 = 4.2 | 1.93 | 20 | 8.1 | 84 |
| c | 7.1 × 7.1 / 2 = −25.1 | −4.7 | 20 | 118 | −502 |
| d | 2 × 7.1 = −14.2 | −7.1 | 21 | 101 | −298 |
| e | 7.1 × 7.1 / 2 = −25.1 | −4.7 | 22 | 118 | −553 |
| f | 2.9 × 2.9 / 2 = 4.2 | 1.93 | 22 | 8.1 | 92.5 |
| g | Total | | | 521 | −597 |

In the usual calculation, only the term $M$ above is calculated, in which case signs (+ or −) are meaningless. This is one of the main advantages of the Mitchell method and also of the method proposed in this article; eliminating the sign eliminates one of the chief sources of error in other calculating methods. From equation 23, $F = \cos C\ Z''\ E\ I\ /\ 1728\ M$ and from equation 22, $Z'' = 12\ e\ T\ L'' = 12 \times 0.00000625 \times 400 \times 22 = 0.66$. $E = 29{,}000{,}000$. $F = 1 \times 0.66 \times 29 \times 3\ /\ 1.728 \times 0.521 = 63.8$ lb. From equation 16, $S = 6\ F\ Y$ max $D''\ /\ I = 6 \times 63.8 \times 7.1 \times 3.5\ /3 = 3170$. From equation 20, $\tan C' = M'/M = -597\ /\ 521 = -1.145$. $C' = 49$ deg.

If the thrust axis had been correctly oriented, the angle $C'$ would be equal to $(C = 0)$. Thus it is shown (in this problem at least) that the Mitchell assumption is in error.

### Thrust Axis Correctly Located

In Fig. 9, the calculation made in Fig. 8 is repeated except that the thrust axis is correctly located by a cut and try process previously explained. It will be noted that the correct value for thrust calculated in Fig. 9 is 70 percent higher than that obtained when using the Mitchell assumption. The value for stress is found to be 31 percent higher. Thus it is seen that a generous factor of safety should be used when employing the Mitchell assumption.

The problem solved in Figs. 8 and 9 was selected to show up the largest error that is likely to be encountered when using the Mitchell method. It has been the practice of the writer, when using the Mitchell method, to call for cold springing during erection of the pipe of one-half of the calculated expansion; but to use the full value of the calculated expansion when calculating stress

[*Continued on page 99*]

# Workmanship in Welding Industrial Piping

**Some of the general considerations involved in welding industrial piping, including assembly and preparation, and the welding processes used, are clearly explained in this authoritative review**

THE FACILITIES available in a permanent shop planned for pipe welding offer an efficient means for securing workmanship of the quality essential in industrial piping. These facilities include power driven machines for cutting and beveling operations, accurate layout equipment, power driven welding positioners, modern welding equipment for manual, semiautomatic, and automatic processes, adequate apparatus for destructive and nondestructive testing, heat treating equipment and efficient material handling devices. Inspection and testing operations are done under close supervision, and control of weld quality is maintained through laboratory research and testing.

While the usual shop erected in the field is seldom as fully equipped as a permanent shop, equally high quality workmanship can be obtained if care is exercised in the design of the shop, the selection of equipment, and in the selection and training of the operating, supervisory and inspection personnel. An important factor in developing uniform, high quality workmanship is the care that is exercised in the use of facilities and a knowledge of their limitations, rather than whether such facilities are of a permanent or temporary nature.

The following has been written for the purpose of outlining in a general way the practices considered requisite by responsible piping contractors and piping fabricators in their daily operations to develop workmanship in pipe welding to a level of quality that will assure acceptance under any specifications.

*The chapter on industrial piping of the new third edition of the American Welding Society's Welding Handbook—from which this material has been taken by special permission—was prepared by a committee consisting of D. H. Corey, The Detroit Edison Co., chairman; A. N. Kugler, Air Reduction Sales Co.; J. D. Mattimore, Tube Turns, Inc.; J. Hall Taylor, Taylor Forge & Pipe Works; H. Weisberg, Public Service Electric and Gas Co.; and C. C. Zimmerman, Benjamin F. Shaw Co.*

## Assembly and Preparation for Welding

*Joint Preparation*—The end preparation of parts to be welded should be done so as to conform as nearly as possible to the joint design set up in the procedure specification. Cutting should be done, as far as possible, with some form of machine tool or mechanically guided oxygen torch. The latter method is limited, of course, to metals which can be so cut and are not adversely affected by the heat involved.

Where continuous type backing rings are to be used, the required taper or counterbore of the pipe ends should conform to a standard gage. Solid backing rings, machined and tool marked for proper spacing in the joint, may be used for this purpose, one for each size and pipe thickness used in the specific construction. This practice will produce uniform ends and allow the interchange of any backing rings conforming to the gage.

All welding faces and adjoining surfaces for a distance of at least 1/4 in. from the edge of the welding groove, or from the toe of the fillet in the case of socket welded or fillet welded joints, should be thoroughly cleaned of rust, scale, paint, oil or grease. Oxygen-cut surfaces should be ground reasonably smooth to remove all traces of scale and any irregularities incident to cutting. Depending on the metal being welded, chemical treatment may be deemed necessary for thorough cleaning of parts and to avoid contamination during the welding.

*Layout and Assembly*—Layout and assembly involves the fitting together of the various component parts comprising a subassembly, or a complete piping system, as the case may be, preparatory to welding. In these operations, dimensional allowances should be made for shrinkage during welding, and the parts to be joined should be carefully spaced, aligned and tack welded together so that the entire assembly will conform to the required dimensions within reasonable tolerances, after welding is completed.

In making up subassemblies the usual procedure is to set up the largest component, either on adjustable trestles or on a level top table, with its longitudinal axis in a horizontal plane. The longitudinal axis and one end of the member are then used as base lines to which the locating dimensions and setting of the smaller parts can be referred, using a rule, steel tape, hand level, squares, straight edge or bevel protractor.

In the layout and assembly of complete piping systems in place, the same general procedure applies; first, the largest horizontal components are erected, and second, these members are used as reference points for fitting and assembling of the smaller components. In such systems, the components, whether they be pipe, valves, fittings or prefabricated assemblies, must be carefully aligned with respect to other structures, equipment and each other. In cases where no thermal expansion, contraction or other movement is involved, the aligning operations present no particular difficulty. Where such movements are a consideration, care must be exercised in both the placement and alignment to make

sure that the system, after it is welded and subjected to service conditions, will position itself in a manner consistent with the design.

In assembling butt type joints, the use of neatly fitting backing rings facilitates spacing and alignment. Where backing rings are not used, the ends of the components to be welded should be carefully aligned and spaced preparatory to tacking, using some convenient spacing gage. Intersecting joints should be carefully laid out, using templates, standard layout curves or jigs. After the parts of the joint have been accurately cut and before they are beveled, it is advisable to make a trial fitting of the joint. This will permit a visual gaging to be made of the corrections that may have to be made for root spacing and alignment, etc., and will reveal any irregularities in the cutting of the parts that may require attention.

If the parts to be welded can be handled manually, the alignment, spacing, and in many cases assembly can be done without the use of external holding devices. In setting up heavy sections, the use of external clamps or other means of holding the parts in correct relationship to each other is essential, not only for maintaining alignment but to facilitate handling.

In production welding, where a number of identical assemblies are involved, the use of a setting-up fixture is of considerable advantage. The design of such fixtures will vary, but the essential requirement is to provide a means for quickly setting component parts in proper relation to each other, ready for tack welding, without requiring individual clamps for each joint.

The dimensional allowances in the layout and assembly of piping systems to compensate for shrinkage during welding are established principally by experience. While it is possible to determine shrinkage for specific cases theoretically, the application of such calculations to all cases encountered in pipe welding is impractical and perhaps of questionable accuracy when it is considered that some of the variables involved in the calculations are functions of the human element.

In the usual types of butt welded joints in carbon steel, or low alloy steel piping of Schedule 40 and Schedule 80 thicknesses, experience indicates that the longitudinal shrinkage in each joint will equal about one-half the root spacing. Diametral shrinkage is negligible and may be disregarded for all practical purposes.

In socket welded or fillet welded joints, both transverse and longitudinal shrinkage are negligible and need not be considered in the layout and assembly operations.

Shrinkage in the welding of intersecting joints results principally in angular distortion of the branch pipe and bowing of the main pipe. In these cases it is virtually impossible to establish even approximate shrinkage values that would hold for all cases. The steps taken to control shrinkage are quite as important as making dimensional allowances for such shrinkage in the layout and assembly operations.

It is quite important therefore in training welders in pipe welding, to emphasize the factors affecting shrinkage so that as they become experienced in applying various welding procedures, they will recognize these factors and approximate their effects in terms of dimensional allowances during layout and assembly operations. Not the least among these factors is the initial fit-up of the joint, and the necessity for careful and accurate preparation of the parts cannot be overstressed in any training program.

The ASA Code for Pressure Piping prescribes minimum requirements applicable to layout and assembly operations preparatory to welding. Detailed information on these operations together with instructions on template preparation and the use of standard layout curves are contained in the Standard Manual on Pipe Welding.

*Tacking*—After the joint is properly lined up, short tack welds are made in the joint prior to actual welding. These welds should be sufficient in number and of suitable proportion to hold the parts in place during ordinary handling. They need not be any higher than one-half the thickness of the pipe wall, nor longer than twice the thickness. They should be of a quality equal to that specified by the welding procedure. Frequently in setting up joints in steel pipe of heavy wall thickness, the need for tack welds in the joints is eliminated by the use of heavy steel bridge clamps.

## PIPING FLEXIBILITY —

[*Continued from page 97*]

and thrust. In this way, the error made by the Mitchell assumption is smothered in a factor of safety.

The data in the following table are taken from Fig. 9. The shaded areas are not shown on this figure to avoid confusing the drawing but the center of gravity of each shaded area is indicated, as before, with a small circle on the pipe.

From equation 20, tan $C' = 81 / 295.2 = 0.272$ and therefore $C' = 15.2$ deg. which is very close (within the accuracy of the calculation) to the assumed value of $C = 17$ deg. Thus it is shown that the thrust axis has been correctly located in this figure. From equation 23, $F = \cos C \; Z'' \; E \; I / 1728 \; M$. $E = 29{,}000{,}000$ psi. $F = 0.965 \times 0.66 \times 29 \times 3 / 1.728 \times 0.2952$. $F = 108.5$ lb. From equation 16, $S = 6 \; F \; Y_{max} \; D'' / I = 4180$ psi. Thus it is seen that the thrust calculated by means of the Mitchell assumption was 41 percent lower than the correct value calculated in this figure. Also the stress calculated by the Mitchell assumption was 21 percent lower than the correct value calculated above.

[To be continued.]

| | Area = $A$ | Arm | | Moment Area | |
|---|---|---|---|---|---|
| | | $Y$ | $X$ | $M$ | $M'$ |
| a | 1.9 x 6.4 / 2 = —6.1 | —1.3 | 2.1 | 7.9 | —12.8 |
| b | 4.1 x 13.6 / 2 = 27.9 | 2.7 | 14.7 | 75.3 | 406 |
| c | 4.1 x 4.3 / 2 = 8.8 | 2.7 | 19.5 | 23.8 | 170 |
| d | 5.5 x 5.7 / 2 = —15.7 | —3.7 | 21.6 | 58.0 | —340 |
| e | 5.2 x 2 = —10.4 | —5.2 | 23.1 | 54.0 | —240 |
| f | 4.9 x 5.2 / 2 = —12.75 | —4.3 | 23.5 | 42.0 | —300 |
| g | 4.6 x 4.8 / 2 = 11.05 | 5.1 | 21.4 | 58.2 | 236 |
| h | Total | | | 295.2 | —81 |

# QUESTION of the Month

**Questions on heating, piping and air conditioning asked by HPAC's readers are answered here each month. We hope you find these practical comments of regular interest, and will contribute either a question or an answer to a published question on occasion. Address the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Illinois**

## What's Effect of Floor Heating in Schools?

IN THE JUNE issue of HPAC, the Question of the Month concerned the desirability of floor type radiant heating for school buildings because of its effect on the occupants. This is a good question and is deserving of careful thought because of the protracted periods of sedentary activity in schoolrooms and, in the case of teachers in particular, the long hours of standing required. A number of opinions exist concerning the limitations of floor heating from a comfort and health standpoint, and in the case of a school building it would be my opinion that a designer or contractor should exercise conservative judgment in selecting the temperature and capacity limits for the floor type system. I do not mean that he should subscribe to the theory which is the most conservative, but rather that in choosing to follow a less conservative course, he base his judgment on authentic data whether they be of the theoretical or practical type.

There are doubtless several hundred radiant heated schools in the United States today for we have a record of nearly 200 using wrought iron pipe. These installations provide an adequate source of data for developing limitations under various conditions, but to the best of my knowledge, no other organization is making use of the field type of investigation for purposes of establishing or verifying design, installation and operating standards.

Instead, recommendations are being based on allowable outputs which, theoretically, will not provide excessive surface temperatures. To date, the only shortcoming to such recommendations is that they are so conservative that the maximum permitted heat output is usually less than the requirement in the average school building. Under these conditions floor type radiant heating would not be usable and the hundreds of satisfied owners of radiant heated schools would have had to resort to some other type of heating.

This entire problem of theory versus practice was discussed in the March 1949 HPAC, and it is sufficient at this time to merely state that in view of the difference of opinion which exists among "authorities", the architect, engineer, contractor or school board faced with a decision regarding radiant heating should, whenever possible, investigate existing installations to arrive at the most reasonable conclusion.

Many codes governing school construction require considerable ventilation in schoolrooms and where outdoor air requirements are high, the load on the heating system may be too severe unless air tempering units are installed. Where unit ventilators, etc. are used, the infiltration load can be reduced greatly and under these conditions floor type radiant heating should be satisfactory for almost any school building regardless of its thermal construction.

A question is sometimes asked concerning the effect of heated floors even though the temperature does not exceed the widely accepted 85 F. There is no record of complaint from discomfort with installations operating under these conditions, but the result of one recent laboratory study presented at the ASHVE convention in Dallas last January led to some greatly disputed conclusions concerning the physiological effect of 75 F or warmer floors on the human body. This particular laboratory study has produced numerous inquiries and although all of the technical and medical authorities with whom I have discussed the study are agreed that the conclusions are unsubstantiated, many individuals have been greatly and probably erroneously impressed by the results. To reassure those who may, because of such laboratory studies, be questioning the desirability of floor type heating, I should like to quote the following opinion of the medical and research authorities of an outstanding eastern university:

"The authors (of the laboratory investigation report) present no data to support their conclusion that the body cannot adjust to the temperature gradients which exist on skin surfaces exposed to heat of the maxi-

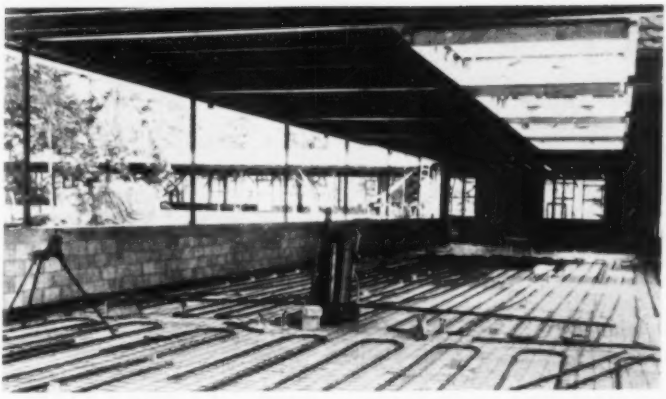
mum degree mentioned in the paper or that such gradients, if present, are harmful."

### Actual Installations Provide Data

In view of the serious differences of opinion which exist concerning theoretical studies, it appears necessary once again to go into the field and find out how successful and satisfactory radiant heating has been after a period of years of actual operation in all sections of the country. While the behavior of such installations might be difficult—or even impossible—to rationalize from a theoretical standpoint, any failure to do so does not jeopardize the radiant heating system or the individuals involved.

One of the oldest radiant heated schools in the United States is the Fairview school at Springfield, Mo., completed in 1943. The floor type system has operated through six complete heating seasons and the results have been most satisfactory.

The heat loss for this school was calculated to be 287,000 Btu per hr and the unit requirement in some rooms is 70 Btu per sq ft of floor area including 15 Btu per sq ft downward loss. The system was designed for 135 F mean water temperature and during the past six years the operating temperature has varied from 120 to 135 F. Whether or not the actual unit heat output has ever reached 70 Btu per sq ft is of course not known although the heat losses were determined according to the ASHVE Guide with an allowance of about 30 percent for downward loss. It is important to note that with low outdoor air temperatures, 135 F water was adequate to provide warmth without foot discomfort.



THIS NEW SCHOOL in North Carolina has a radiant heating system of wrought iron pipe bent into sinuous coils and embedded in the concrete floor slab

Similar reports have been received from five other schools and our field engineers have received verbal reports of satisfaction from over 20 others we have personally investigated. The heating and control requirements in some of these buildings are even more severe than in the case of the Fairview school. The Summit school, Reynolds, N.C., has a maximum unit requirement of 89 Btu per sq ft and the Avon school, Avon, Conn., has a requirement of 75. The Miquon school, Miquon, Pa., has an "observation room" with a requirement of 120 Btu per sq ft, but such a load would normally be considered excessive for constantly used classrooms. Two Canadian installations were described in the September 1947 issue of School Progress and these systems are undoubtedly required to meet higher heating loads because of the cold climate. On the other hand, the lighter heating loads experienced in Louisiana, Southern Texas, Arizona and California are accompanied by a greater control problem. Despite theoretical claims to the contrary, floor type systems are proving practical in these areas. The Will Rogers school, Amarillo, the Isidore Newman school, New Orleans, and the

## Contractor Reader Asks Data on Hot Gas Defrosting

*YOU ARE invited to answer the following question, which has been submitted by a reader of HPAC who is a heating, air conditioning and refrigeration contractor. Suitable comment on the matter will be welcomed and —space permitting—will be published. Address your reply to the Editor, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*

"A proposed hot gas defrosting scheme intended for the refrigeration systems to be installed in a new Veterans Administration hospital incorporates an automatic defrosting valve which is new to the writer. While it is called "automatic," it is automatic only to the extent that it is supposed to close by itself when the refrigeration coil, at its leaving side, has warmed up (by virtue of its hot gas content) to the equilibrium temperature of the normal high side liquid. Of course, it must be manually reset to the open position for each successive defrosting operation.

"There are 12 such units, plus three sets of plate coil, connected into the same condensing unit assembly. It is not intended, however, that all of these be defrosted at the same time.

"The defrosting valve is, in effect, a reverse acting expansion valve. I am at a loss as to where such a valve might be obtained and wondered if you might be able to help me. Comments in regard to such a hot gas defrosting system, generally, would also be sincerely appreciated."—F. E.

Knox school, San Antonio, are the latest to report complete satisfaction.

One of the best indications of satisfaction is the decision by an engineer or architect to specify radiant heating for a school building on the basis of experience. In Bangor, Me., Eaton Tarbell and Associates designed a radiant heating system for the Fairmont school which was completed in 1949. During the past winter, the results were so satisfactory that a second school building will also be radiant heated. In the case of the Fairmont school, approximately 80 percent of the heating load at –20 F outside air temperature will be handled by the floor system. A design water temperature of 120 F was selected and the piping consists mainly of ¾ in. wrought iron on 12 and 16 in. centers. In this instance the state code for school buildings necessitated the circulation of tempered air so that it was not necessary for the radiant heating system to carry the full load.

If the use of floor heating in school buildings were as "dangerous" as some individuals have indicated, it would seem reasonable to expect that a sizable proportion of the several hundred installations completed today would have experienced discomfort or other dissatisfaction. With the variety of design methods and design conditions encountered, it would be unwise to assume that no dissatisfaction of any kind exists in any radiant heated school, but the evidence provided by well-engineered systems is overwhelmingly conclusive in favor of radiant heating.

The only reasonable answer to the June Question of the Month then is that if the conditions surrounding the proposed school are the same or similar to an existing satisfactory installation, then a floor type radiant heating system should be completely satisfactory.—PAUL S. PARK, until recently manager, engineering service dept., A. M. Byers Co., and now associated with C. A. Hawk, Jr., consulting engineer.

## VENT STACK TO SOLVE SHAMPOO PIPING PROBLEM

IN ANSWER to the shampoo process piping problem published on page 104 of the October HPAC, the waste stack should be extended full size through the roof of the building to provide an adequate vent for the drain pipe.

In the absence of an adequately vented stack, there is a tendency for the trap seals to be blown dry on the lower floors and siphoned dry on the upper floors below the point that the load enters the vertical pipe.

As the stack pressure is relieved at the lower floor levels, the practically weightless soap bubbles are forced out of the now unsealed floor drains.

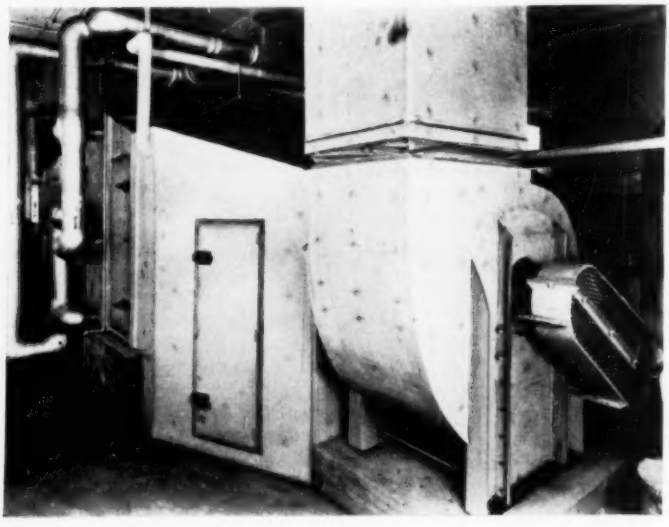
If the extension of the drain pipe through the roof does not fully correct the difficulty, a small vent line should be provided connecting the individual floor drain branch lines to the main stack at a point above its highest inlet. The rate of discharge of the principal stack loads should determine the size of this dry vent. It can be constructed of steel pipe using screw type cast iron drainage fittings and the cost should not be excessive.

The same problem is often encountered when an automatic washing machine with a high velocity discharge pump is connected into an unvented branch soil line that has a floor drain.—E. T. L.

## INSULATING AIR CONDITIONING SYSTEM

A UNIQUE method of applying mineral wool board insulation to air conditioning equipment recently enabled the William Penn hotel, Pittsburgh, to eliminate several time-and-material-consuming steps normally required to insulate such equipment, according to the Industrial Mineral Wool Institute. The technique includes three basic steps: application of (1) special clips and (2) mineral wool board sections and (3) two coats of paint.

SPECIAL CLIPS were used to fasten the insulation for this air conditioning equipment at the William Penn hotel



The clips which secure the insulation are attached to the sheet metal by an adhesive. Each clip consists of a 1½ in. square metal plate, punctured with small holes, and a length of heavy gage wire welded perpendicularly to the metal plate at its center. The punctured metal plates are pressed into the adhesive on 12 in. centers.

Mineral wool board insulation in 24 x 48 in. sections is then impaled on the wires of the clips with all edges carefully butted together. To secure the insulation, a lock washer is tightly set on each protruding wire. The ends of the wires are then clipped at the washers. Insulation corners and joints and the tops of the washers are covered with 10 lb asbestos paper carefully secured in place with cold water paste. To complete the insulation, two coats of paint are applied to all insulated surfaces.

# Sam Lewis's Page

INFORMAL COMMENT on heating, piping and air conditioning matters is given in this regular feature by Samuel R. Lewis, consulting mechanical engineer, and a member of HPAC's board of consulting and contributing editors.

## HAS TROUBLE WITH AIR IN SYSTEM

HERE IS AN interesting inquiry from New Zealand:

"We have been experimenting with closed central hot water heating, which we understand is used in the U. S. A. Our systems operate on the two pipe system with a correctly sized expansion vessel. We use galvanized iron piping and either cast iron or steel radiators. We operate on temperatures of from 200 to 220 F. We have considerable trouble with accumulations of air in the top parts of our radiators. Some of the 'air' appears to contain a large proportion of hydrogen gas.

"We would like to know whether American engineers have similar troubles. We would also like to know what means are taken to overcome them."

I have a forced circulation hot water heating system similar to that described. Each radiator has a manual air vent. My expansion tank is above the radiation. About once each heating season I test the air vents and find that the air has accumulated in one particular radiator. After venting that one, the plant operates without trouble until the next heating season (unless for some unusual reason the system is drained.)

We design many hot water heating systems, and always provide for such pitching of the mains that air in the mains must flow to some convenient high point that easily can be vented. On very large installations, as in hospitals and commercial buildings, float operated air vent valves having drainage to some visible outlet above a drain are provided. Trouble in air venting can be avoided if the same skill in piping design is exercised as is required for ultimate drainage of water and for temperature distribution.

I have not experienced any ill effect due to long intervals between water replacement, and if the water supply comes from a source that tends to promote an unusual amount of entrainment of air or other gas, such gases soon separate and can be removed. It is always inadvisable to install radiators on a domestic hot water system (where the water constantly is being renewed due to use in lavatories and the like).

I wonder if it is possible that this New Zealand reader has been trying to operate a hot water heating system with so-called "steam" radiators, which have only bottom connections between the sections?

## HEATING ENCLOSED PORCH AREA

A PHILADELPHIA reader has an enclosed porch that he wishes to heat with radiant energy. The building has a warm air furnace. The porch has a concrete floor which is on the ground.

This is not what I would call an easy job for which to prescribe.

The chances are that the present floor is level with the floor of the building, thus militating against raising the porch floor to a higher level. However, one often steps down from a room to a porch, and perhaps he could step up to this one.

The porch is not large. There is no suggestion, in the data given, as to whether it is desired to install a separate heating plant for the porch or whether channels can be cut in the floor. I have heated two or three new additions to existing structures by ducts that warm the floor.

I would not hesitate to tackle this particular porch if I might cut through the concrete, say along one side, to install an air supply header duct and along the opposite side to form an exhaust or recirculating header duct. I would connect these ducts across the porch with transverse hollow tubes such as are available from clay tile manufacturers. Then I would lay a new concrete floor above the tile ducts.

### Separate Air Duct from Furnace

There would be a separate warm air duct from the furnace to feed the supply header, and a return air duct to the fan at the furnace from the return header. Air in this circuit would be recirculated, by the present fan, or in case there is no present fan, by a new fan devoted exclusively to the porch, and that could stop and start as directed by a thermostat in the porch. This construction would necessitate raising the top of the porch floor perhaps one step above its present level or would require removing the entire porch floor and installing a new floor. There are available thin walled fiber ducts that could be used instead of clay tiles. One even could consider using discarded steel boiler tubes instead of clay tile for the transverse air ducts, since they become merely forms to support the new concrete.

I know of cases where 4 in. galvanized sheet steel rain water conductor pipes were employed. The transverse pipes could be spaced about as far apart as their own outside diameter. Thus, if 4 in. tubes were employed, their centers would be 8 in. apart.

If the warm air temperature is around 135 deg, the usual design temperature, the header ducts and the ducts to and from the furnace could be no larger than would be the ducts of a conventional warm air heating system for the room in question.

DATA sheet

# How to Size Piping for Antifreeze Solutions

**Viscosities and specific gravities have been determined by W. P. Armstrong, assistant professor of chemical engineering, and C. J. Kippenhan, assistant professor of mechanical engineering, Washington University, for aqueous solutions of pure ethylene and propylene glycol for compositions from 20 to 100 weight percent and temperatures from 0 to 200 F. Two commercial ethylene glycol antifreeze solutions are shown to have viscosities and gravities averaging 5 percent and 0.3 percent, respectively, above the pure solution values. Charts constructed from these data enable direct calculation of antifreeze friction loss in commercial pipe from handbook values of water head loss for the same conditions of pipe diameter and throughput.**

ETHYLENE GLYCOL is used in large quantities in antifreeze solutions. In spite of its increasing economic importance, only meager data have been available to engineers for the design of heat transfer systems involving glycol solutions (such as for snow melting piping systems, for example). As a first step in supplying the missing physical property values, the work described here furnishes data needed for friction loss calculations in piping systems.

Values of viscosity and specific gravity are given in Tables 1 and 2 for ethylene glycol-water solutions and for propylene glycol-water solutions at various concentrations and temperatures. These values enable direct graphical calculation of head loss in commercial pipe by means of Figs. 1 and 2. Although ethylene glycol is unquestionably the most important nonvolatile antifreeze, other higher alcohols have been suggested (see References 1 and 2). Propylene glycol was included in this work as an alternative antifreeze of general interest. Since commercial antifreezes contain small amounts of corrosion inhibitors, foam suppressants and anti-seep agents, which might affect the viscosity and density, several check points were run on two commercial ethylene glycol products.

## How the Values Were Determined

Aqueous solutions of 20, 40, 60 and 80 percent glycol were prepared by weighing the calculated amounts of chemically pure glycols and distilled water. Measurements were made at five temperatures covering the range of practical interest in heat transfer systems by means of an acetone-dry ice bath at 0 plus or minus 1 F, and water baths at 50 plus or minus 0.2, 100 plus or minus 0.2, 150 plus or minus 0.2 and 200 plus or minus 1 F. Temperatures were checked against a Bureau of Standards calibrated thermometer.

Specific gravities were determined by weighing the solution contained in pycnometers previously calibrated with distilled water. Corrections for air buoyancy and expansion of glass were applied. Viscosities were obtained from measurements of the flow time of 10 ml samples in Ostwald viscometers suspended in the temperature baths. The viscometers were calibrated against distilled water and several aqueous glycerol solutions.

Tables 1 and 2 summarize absolute viscosities and specific gravities for solutions of the pure ethylene and propylene glycols respectively. Table 3 gives the check point values obtained on Du Pont "Zerex" and National Carbon Co. "Prestone" solutions.

The specific gravity data are accurate within one unit in the third decimal place. This was attested by the consistency of smooth curves through the points plotted as gravity versus percent glycol, and by the fact that known errors in the measurements affected only the fourth decimal place. The viscosity data are accurate to three significant digits. This also was shown by the consistency of smooth curves through the points which extrapolated smoothly to the literature values for pure water.

It is interesting to note from Table 3 that these solutions, when compared with the pure glycols, show deviations in viscosity averaging plus 5 percent and in density averaging plus

0.3 percent. Thus, the data for the pure glycols may be applied satisfactorily to engineering calculations on the commercial antifreeze solutions.

### Calculating Friction Loss in Piping

Friction loss calculations for water flowing in piping systems are frequently made by referring to handbook tables of head loss for various conditions. For systems containing glycol solutions, it would be desirable to make use of the head loss tables for water and then to apply a correction factor based on the composition and temperature of the glycol solution. This can be done by means of Figs. 1 and 2, which were developed from the basic data of Tables 1 and 2.

A study of the Fanning friction equation indicates that only the friction factor is dependent on the physical properties of the fluid. Hence, a head loss correction factor would be essentially the ratio of the friction factor for glycol solution to the friction factor for water in a standard reference state. The friction factor is a function of the Reynolds number, which in turn depends directly and only on kinematic viscosity for a given pipe size and throughput. Therefore the head loss correction factor (friction factor ratio) can be obtained directly from the ratios of kinematic viscosity for the glycol solutions and water.

For a given reference state of water, this kinematic viscosity ratio is dependent only on the glycol solution composition and temperature. Thus, if the function relating friction factors to Reynolds numbers is available in a simple form, an overall direct relation between head loss correction factors and glycol compositions can be established. This has been accomplished in the construction of Figs. 1 and 2. In constructing the charts, the approximation was made that the curve of friction factor for fluids in commercial pipe plotted versus Reynolds number ($Re$) on logarithmic coordinates is a straight line in the turbulent range between $Re = 2.5 \times 10^3$ and $10^6$. Inspection of this well known plot shows that this is an excellent approximation, well within limits satisfactory for ordinary engineering work.

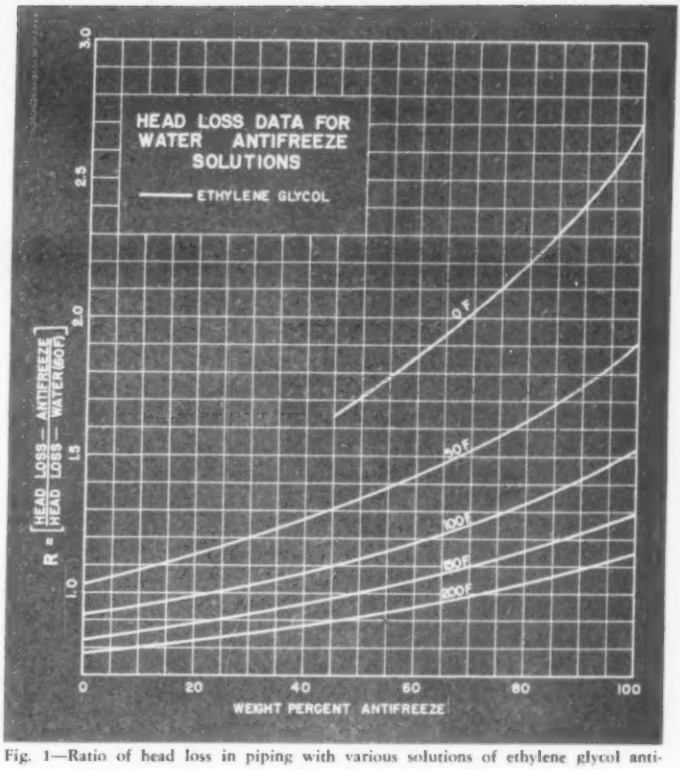



Fig. 1—Ratio of head loss in piping with various solutions of ethylene glycol antifreeze at different temperatures to head loss with water at 60 F

A straight line on logarithmic coordinates has the general form $\log f = \log C + m \log Re$. In this particular case, the straight line approximation to the curve for commercial pipe has the slope $m = -0.2$. Then, for the glycol friction factor and water reference factor, $\log f - \log f_o = \log C - \log C - 0.2 \log Re + 0.2 \log Re_o$. This simplifies to $(f/f_o) = (Re/Re_o)^{-0.2}$. Since Reynolds number is inversely proportional to kinematic viscosity, the desired simple relation between friction factor and kinematic viscosity is obtained: $(f/f_o) = (V/V_o)^{0.2}$.

Figs. 1 and 2 were constructed using the kinematic viscosity of water at 60 F as reference. Values of $(V/V_o)$ for various glycol solution compositions and temperatures were tabulated using data from Tables 1 and 2. Values of $(f/f_o)$ were then calculated and plotted versus weight percent antifreeze with temperature as the parameter.

### How to Figure Head Loss

Head loss in piping systems containing glycol solutions is calculated as follows. First, the head loss for

Table 1—Absolute viscosities and specific gravities of aqueous ethylene glycol solutions

| Weight, percent | Temperature, F | | | | |
|---|---|---|---|---|---|
| | 0 | 50 | 100 | 150 | 200 |
| 0 | | 0.9997 | 0.9930 | 0.9802 | 0.9631 |
| | | 2.752 | 1.424 | 0.905 | 0.637 |
| 20 | | 1.026 | 1.016 | 1.005 | 0.984 |
| | | 4.72 | 2.18 | 1.30 | 0.90 |
| 40 | 1.064 | 1.055 | 1.042 | 1.027 | 1.006 |
| | 29.7 | 7.53 | 3.56 | 2.00 | 1.26 |
| 60 | 1.097 | 1.082 | 1.065 | 1.046 | 1.025 |
| | 60.8 | 14.7 | 5.99 | 3.08 | 1.86 |
| 80 | 1.122 | 1.103 | 1.084 | 1.064 | 1.043 |
| | 136 | 29.3 | 10.5 | 5.16 | 2.90 |
| 100 | 1.138 | 1.119 | 1.100 | 1.080 | 1.060 |
| | 884 | 67.3 | 21.0 | 9.12 | 4.93 |

Notes—Viscosities and gravities of water taken from Handbook of Chemistry, N. A. Lange, 6th ed. Specific gravities (upper numbers in table) are ratio of density at temperature to water density at 4 C. Viscosities (lower numbers in table) are (lb sec/ft²) x 10⁵.

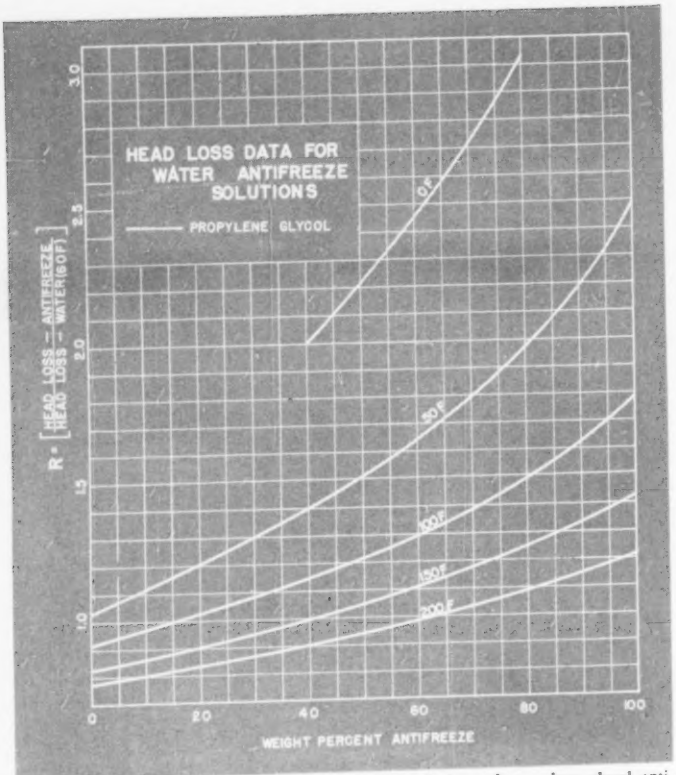



Fig. 2—Ratio of head loss in piping with various solutions of propylene glycol antifreeze at different temperatures to head loss with water at 60 F

water at 60 F at the same throughput and pipe diameter is taken from the handbook table. Second, the correction factor for the given glycol composition and temperature is obtained from Fig. 1 or 2. Third, the head loss for water is multiplied by the glycol correction factor to give the head loss for glycol at the given throughput and temperature.

A typical calculation is made as follows, given pipe diameter as 1 in., the flow rate as 20 gpm, the ethylene glycol composition as 80 percent, and the solution temperature as 50 F.

From a head loss table (Reference 3) the water head loss is found to be 25.6 ft per 100 ft of pipe. From Fig. 1, the correction factor at 80 percent and 50 F is 1.63. Therefore the antifreeze solution head loss is (1.63) (25.6) = 41.5 ft.

The head loss based on rational calculation by the Fanning equation and standard curve for friction factor versus Reynolds number yields a value of 38.5 ft. Thus, the use of Fig. 1 yields a result approximately 7 percent more than the long form computation. Had a different head loss table been chosen (Reference 4) the result would have been approximately 20 percent greater than by the Fanning method.

These results thus indicate that the proposed method of friction loss calculation for glycol solutions is within the range of engineering accuracy. It should be emphasized, however, that the proposed approximation is valid only in the turbulent range; thus, in problems where laminar flow is approached (at low temperature, low flow rates, in small pipes) it is desirable to use the rational method for friction loss calculations.

Table 2—Absolute viscosities and specific gravities of aqueous propylene glycol solutions

| Weight, percent | Temperature, F | | | | |
|---|---|---|---|---|---|
| | 0 | 50 | 100 | 150 | 200 |
| 0 | | 0.9997 | 0.9930 | 0.9802 | 0.965 |
| | | 2.752 | 1.424 | 0.905 | 0.637 |
| 20 | | 1.017 | 1.007 | 0.991 | 0.972 |
| | | 6.04 | 2.52 | 1.44 | 0.92 |
| 40 | 1.047 | 1.035 | 1.022 | 1.001 | 0.980 |
| | 78.8 | 19.8 | 4.87 | 2.36 | 1.42 |
| 60 | 1.065 | 1.048 | 1.030 | 1.009 | 0.985 |
| | 224. | 51.4 | 9.19 | 4.13 | 2.17 |
| 80 | 1.069 | 1.050 | 1.030 | 1.009 | 0.984 |
| | 654. | 78.5 | 18.7 | 7.14 | 3.54 |
| 100 | 1.060 | 1.043 | 1.023 | 1.001 | 0.978 |
| | | 242. | 44.7 | 14.2 | 6.14 |

Notes—Viscosities and gravities of water taken from Handbook of Chemistry, N. A. Lange, 6th ed. Specific gravities (upper numbers in table) are ratio of density at temperature to water density at 4 C. Viscosities (lower numbers in table) are (lb sec/ft²) x 10⁵.

Table 3—Absolute viscosities and specific gravities of aqueous solutions of commercial antifreezes

| Weight, percent | Temperature, F | | Weight, percent | Temperature, F | |
|---|---|---|---|---|---|
| | 100 | 150 | | 100 | 150 |
| | *DuPont "Zerex"* | | | *National Carbon "Prestone"* | |
| 40 | 1.042 | 1.025 | 40 | 1.044 | 1.027 |
| | 5.68 | 2.00 | | 5.56 | 1.95 |
| 60 | 1.067 | 1.047 | 60 | 1.070 | 1.050 |
| | 6.25 | 3.42 | | 6.05 | 3.35 |
| 100 | 1.102 | 1.081 | 100 | 1.108 | 1.088 |
| | 24.2 | 10.3 | | 22.5 | 9.35 |

Notes—Specific gravities (upper numbers) are ratios of density at temperature to water density at 4 C. Viscosities (lower numbers) are (lb sec/ft²) x 10⁵.

## Symbols Used in This Article

$C$ is an arbitrary constant.

$f$ is the friction factor for antifreeze solution.

$f_o$ is the friction factor for water at reference condition, and at the same pipe size and throughput.

$m$ is the absolute slope of a line on logarithmic coordinates.

$Re$ is Reynolds number for antifreeze solution.

$Re_o$ is Reynolds number for water at reference condition, and at the same pipe size and throughput.

$V$ is kinematic viscosity.

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*Heating, Piping & Air Conditioning*

THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

*JOURNAL* *SECTION*

# Smoke Measurement in a Fuel Oil Test Unit

By David W. Locklin* and George V. Parmelee**
Cleveland, Ohio

**This paper is the result of research carried on by THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, in cooperation with the Oil-Heat Institute of America, Inc., at the ASHVE Research Laboratory, located at 7218 Euclid Avenue, Cleveland 3, Ohio.**

**SUMMARY—This paper reports the results of an investigation of smoke measurement methods used in connection with a fuel oil combustion test unit designed by the *Oil-Heat Institute of America, Inc.* The light transmission and filtration methods of measuring the smoke density of oils burned in the unit are described and observations by the two methods are compared. The relationship between visual and photoelectric evaluations of smoke-soiled filter papers is also given.**

PRESENT-DAY methods of producing gasoline from crude oil have markedly affected the chemical composition and physical structure of those by-products which remain for use as fuel in oil burners. This is particularly true of the lighter portions which are used in domestic heating units. Whereas some years ago oil burner fuels were the product of straight-run distillation or thermal cracking processes, present-day fuels may contain or consist entirely of products from catalytic cracking plants. Experience has shown that such fuels may have different burning properties than fuels from a straight-run distillation process although both may possess physical properties that place them in the same classification.

To permit the proper selection of fuel for the thousands of oil burners now in use, some method of determining the burning characteristics of fuel oil is needed. One method which has been proposed for obtaining these characteristics for various oils is to study their combustion in a test unit which closely simulates typical field conditions and to compare the oils on the basis of their observed burning performance. The test unit referred to in this paper is a pressure atomizing type unit designed by the *Oil-Heat Institute of America, Inc.*, through whose Engineering Committee arrangements were made in 1947 with the Committee on Research of THE AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS for conducting a series of investigations.

A preliminary field investigation was made in December 1947 for the purpose of determining, in a general way, whether the test unit could be used to differentiate between various fuel oils. The principle criterion of fuel performance was considered to be the smoke production with respect to excess air supplied. The field observations made showed that the unit had definite possibilities but that improvements in instrumentation and techniques were required if it were to be used as a means of rating fuel oils. Two extensive series of tests were therefore made during 1948 and 1949 at the ASHVE Research Laboratory in Cleveland.

This paper and a companion paper summarize the investigations and tests mentioned. The scope of this paper is confined to the methods of smoke measurement used with the unit, while the second paper[1] de-

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[1]Exponent numerals refer to References.

scribes the performance of the unit and several different fuel oils which were burned in it.

## Description of Test Unit

Fig. 1 shows a schematic diagram of the unit and a portion of its instrumentation. The engineering staff of the ASHVE Research Laboratory made certain changes during the course of this study and completed most of the instrumentation. A photograph of the unit as set up for the second series of tests is shown in Fig. 2.

Basically the unit consists of a pressure-atomizing-type burner firing axially into a cylindrical water-jacketed combustion chamber, a portion of which is lined with refractory material as shown. The nozzle has a nominal capacity of 1 gph and produces a hollow-cone spray. Flame length was determined by noting the position of the movable water-cooled baffle at which the flame tips just reached the plane of the baffle surface. Air supply and combustion chamber draft were controlled by adjusting (1) the cold air inlet damper located in the outlet of the smoke observation tube, (2) the butterfly damper in the exhaust flue, and (3) the iris type air supply shutter.

## Methods of Smoke Measurement

Investigators have used many different techniques for smoke measurement, both qualitatively and quantitatively, in considering combustion efficiency and atmospheric pollution. These techniques may be classified as follows:

1. Visual shade comparison of smoke issuing from a stack.
2. Transmission of radiant energy.
   - A. *Radiant Source*
     - *a.* Chromatic
     - *b.* Monochromatic
   - B. *Transmission*
     - *a.* Direct
     - *b.* Reflection
   - C. *Measurement*
     - *a.* Photoelectric effect
     - *b.* Thermal-electric effect (bolometric)
   - D. *Sampling*
     - *a.* Measurement in stack on effluent gases
     - *b.* Measurement on sample withdrawn from stack
3. Deposit
   - A. *Collection*
     - *a.* Filtration
     - *b.* Sedimentation
     - *c.* Impingement
     - *d.* Inertial and centrifugal
     - *e.* Washing
     - *f.* Precipitation: (*a*) thermal (*b*) electrostatic
   - B. *Evaluation*
     - *a.* Weight
     - *b.* Chemical analysis
     - *c.* Light transmission
     - *d.* Light reflectance
     - *e.* Microscopic particle size count
     - *f.* Visual shade comparison

These techniques are discussed in articles which are listed chronologically in the Bibliography.

## Methods Used

*Direct Light Transmission Measurement in Stack*

The unit, as originally designed, incorporated a smoke indicating device patterned after that used by the *Underwriters Laboratories, Inc.*[2] A photronic cell indicated the reduction, due to smoke, of chromatic light transmission through a horizontal breeching 5 ft long, as shown in Fig. 3.

A 100-watt projection lamp and a photronic cell were mounted at opposite ends of the breeching behind protective glass slides. Difficulties in keeping these glasses free of soot prompted the addition of 9-in. extensions of 2-in. copper tubing between the breeching and glasses. Holes drilled in these extensions permitted air to be bled into the system for the purpose of clearing the tube of eddying smoke and keeping the photocell cool. The system was *zeroed* with a clear but hot stack by adjusting the lamp voltage so that the output of the photronic cell was 8.0 microamperes. The light absorption due to smoke and flue gases in the breeching during operation was indicated by the reduction in the photronic cell output.

Experience in the first series of tests showed that this method of measurement lacked the desired sta-

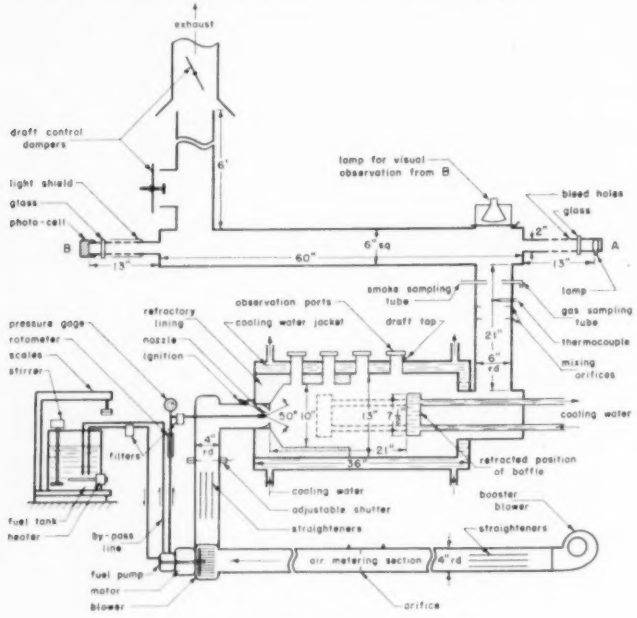


Fig. 1—Schematic elevation of test unit

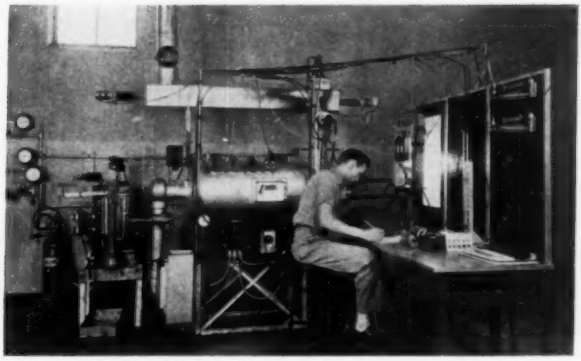

Fig. 2—The combustion test unit during tests

bility and sensitivity at light smoke densities. A supplementary smoke indicating device was therefore investigated for the second series of tests in order to improve reproducibility and range; these characteristics were achieved by the choice of the *filtration* method.

*Filtration Method*

In this method of smoke indication, a cooled sample of flue gas was drawn through a filter paper for a one-minute period and the deposition of soot particles on the filter paper evaluated as an indication of the smoke. This system is schematically shown in Fig. 3. A spring loaded relief valve maintained the pressure differential across the filter paper constant at an indicated suction pressure of 2¼ in. Hg. The resistance of the No. 4 Whatman filter paper used was such that the spot area of 0.216 sq in. would pass approximately 10,000 cc of gas sample per minute at this differential pressure.

In the second series of tests the smoke spot obtained on the filter paper was evaluated by visual comparison with a 9-shade Bacharach-Shell scale[2]. This procedure had certain shortcomings for the purpose of these tests because of the varying effects of particle size, color, light transmission, surface properties, and the human error in judgment. The lack of uniformity of different shade scales also made it difficult to compare results for smoke spots which have been evaluated by different scales. It was therefore decided to use photometric means of evaluating the smoke spots for the third series of tests; the light reflectance of the filter smoke spots was measured by a photoelectric reflection meter, with a green filter[3].

The reflectances of three arbitrary standards were determined by using the absolute reflectance of a block of magnesium carbonate as reference. In evaluating smoke spots the reflection meter scale was adjusted with these standards to read percent absolute reflectance directly. The absolute reflectance of a clean portion of each filter was determined in order that the reflectance of the smoke spot could be expressed relative to that of the clean filter paper. *Percent relative reflectance* is then the percent absolute reflectance of the smoke spot expressed as a percentage of the percent absolute reflectance of the clean filter paper.

Fig. 4 shows the relationship obtained between smoke spot reflectance and the Bacharach-Shell visual shade scale. Reflectance readings of a given surface were considered reproducible to ± 0.2 percent absolute reflectance; therefore differences in readings of smoke spots taken under the same conditions were due to factors other than the reflectance measurement, such as unsteady combustion and nonuniform sampling. Variations from the averaged smoke spot evaluations at a given setting were generally within ± 2 percent relative reflectance for the lighter oils investigated and within ± 5 percent for the heavier oils.[1]

*Characteristics of Light Transmission and Filtration Methods*

The optical density of smoke indicated by the light transmission method is given by the expression[4]

$$D = \log_e I_o/I \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

*where*

$D$ = optical density indicated
$I_o$ = intensity of incident light
$I$ = intensity of transmitted light

Beer's law for light absorption is

$$I_o/I = e^{k_1 n L d} \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

*where*

$e$ = base of natural logarithms
$k$ = a constant
$n$ = concentration of smoke in particles per unit volume of gas

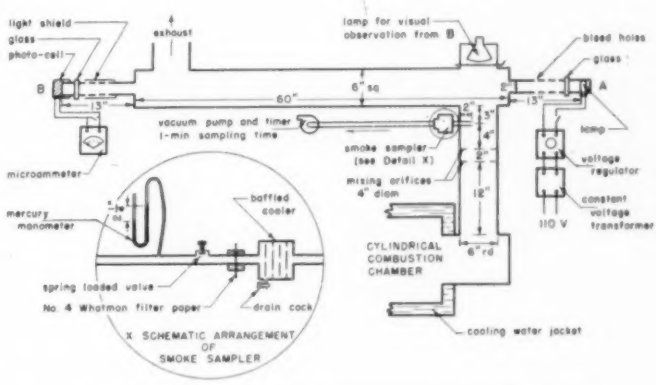


Fig. 3—Schematic diagram of smoke measuring equipment for test unit

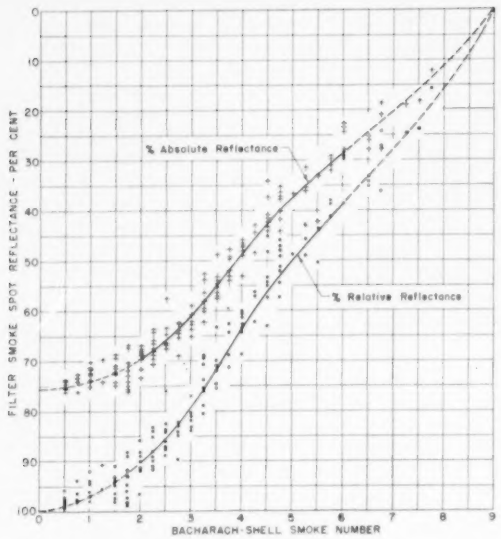


Fig. 4—Smoke spot evaluation—reflection meter *vs.* visual

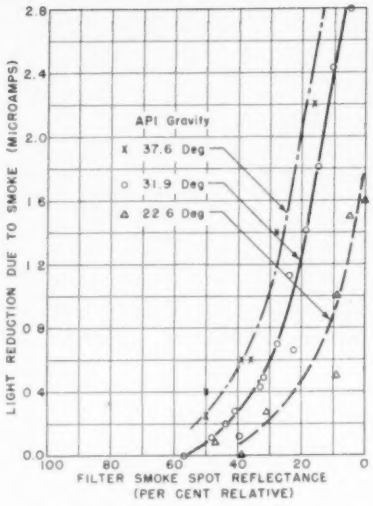
API Gravity
x 37.6 Deg
o 31.9 Deg
Δ 22.6 Deg
LIGHT REDUCTION DUE TO SMOKE (MICROAMPS)
FILTER SMOKE SPOT REFLECTANCE (PER CENT RELATIVE)

Fig. 5—Relation of smoke measurement by light transmission and filtration methods

$L$ = length of the smoke column
$d$ = mean diameter of the particles

Combining Equations 1 and 2 gives

$$D = k_3 n L d \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

For a given smoke meter the optical density indicated becomes

$$D = k_4 (n d) \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

Thus smoke measurement by light transmission methods is affected by both concentration and mean size of smoke particles.

In the operation of the unit it was found that the relation between the light transmission and the filtration methods was not well defined due to scatter of data; it was apparent, however, that the relation for each oil was different. Smoke data by the two methods are shown in Fig. 5 for three representative oils. It is seen that the light transmission method which was used was not successful in detecting light smoke, although it is recognized that an improvement might be made by refinement of the photronic circuit.

By simultaneously taking filter paper smoke spots and sighting through the breeching from location B of Fig. 3, with illumination from the upper lamp, it was observed that smoke spot reflectances corresponding to the *just visible* smoke were quite different for different oils. This was believed due to differences in particle sizes of the smoke. A portion of this effect could be attributed to sampling characteristics of the filtration system.

The efficiency of sampling was not investigated in detail; however, certain factors are recognized which may have an effect upon sampling. In order to maintain the simplicity of the smoke indicating methods for field use, the smoke sampling tube was inserted into the stack as indicated in Fig. 3 and the sample was drawn at right angles to the flue gas flow. Variations in the particle size of the smoke, and variations in stack velocity, could conceivably affect the results when sampling in this way. The mean gas velocity in the sampling tube was roughly half that in the stack, though it has been shown[5,6] for sampling tubes directed upstream that the sampling velocity must be equal to the stack velocity in order to insure a representative sample. When the filtration method was used with very dense smoke it was necessary between readings to purge the sampling system of residual soot by drawing a sample of room air through it at high velocity.

It was evident by inspecting filter smoke spots that the particle sizes of the soot deposit were greater for heavier oils than for the lighter oils. The photometric reflectance evaluation of the spots did not completely obviate particle size effects since an identical reflectance reading could be obtained for a large concentration of small particles or a lower concentration of larger particles. Such a characteristic is also inherent in the direct light transmission method. Particle size and shape may have a practical bearing upon aerodynamic suspension of particles in the gas stream, and therefore upon soot deposit on various surfaces.

One feature of the filtration method which was considered desirable for this investigation was the integration of the smoke over a period of time. Although tests were made under steady combustion conditions there were times when intermittent, and sometimes audible, pulsations made readings difficult by the light transmission method. The instantaneous feature of the latter method, however, makes it valuable in certain applications.

In a recent paper[7] reporting the simultaneous measurement of smoke

by three methods, the *ICHAM* deposit, direct light transmission, and filtration, it was concluded that all of these are indicative of different aspects of smoke, such as gumminess and particle size, rather than the smoke quantity itself; thus the methods cannot be directly correlated for different conditions.

Methods of smoke measurement should be investigated in order to determine their relation to a weight concentration evaluation. In addition to weight of smoke production, it may be important to consider other aspects of the smoke and their effects upon combustion efficiency, heat transfer, and sooting of flue passages.

## Conclusions

1. Smoke indication by the filtration and light transmission methods did not bear a consistent relationship.

2. Of the two techniques used, the filtration method, with evaluation by photometric reflectance, was the most suitable for use with the test unit. This choice was due to the following considerations:

*a.* This method possessed greater sensitivity and range in the region of light smoke.

*b.* A consistent relation was established between visual and photometric reflectance evaluation of filter smoke spots.

3. Further investigation is required on the effects of different sampling techniques.

4. Various aspects of the smoke production which are indicated by different methods should be investigated in relation to weight concentration of smoke and their effects upon appliance performance.

## Acknowledgment

The authors acknowledge with thanks the cooperation and suggestions received from their colleagues of the ASHVE Research Laboratory staff and members of the Engineering Committee of the *Oil-Heat Institute of America, Inc.*

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# Recirculation from Industrial Exhaust Systems†

By Arthur C. Stern* and Donald P. O'Neil**, New York, N. Y.

**SUMMARY — Recirculation of industrial process exhaust air to the workroom conserves heat during cold weather. Because recirculation should be kept to a minimum throughout the year to reduce dust, odor, smoke and heat in the workroom, control systems are needed. Two such systems based on outdoor temperature are proposed and methods for calculating the net annual recirculation, heat saving and saving in required heating plant capacity are described. The simpler on-off control system discharges all process exhaust out of doors whenever the outdoor temperature exceeds any chosen control temperature. The more advanced modulating type of control regulates the amount of air discharged out of doors and that returned to the building; the relative proportions varying with the outdoor temperature.**

THE MOST common reason for wanting to recirculate to a workroom the air discharged from industrial process exhaust systems is to effect savings by eliminating the heating of outdoor make-up air during the heating season, and by reducing the heating plant capacity required to heat this air. It is generally agreed that these savings are never a valid reason for recirculating any process effluent which could be detrimental to the health and well being of the persons employed in the workroom. All such detrimental effluents must therefore be discharged completely to the outer air and replaced in the workroom by an equivalent amount of outdoor make-up air. There are, however, some effluents which, after passing through a dust, mist, fume or vapor separator, are no more contaminated than the outdoor air available for make-up. In such cases it is difficult, if not impossible, to prove any detriment to the health of workers because of the residual contamination of the effluent if it were to be recirculated to the workroom.

During warm weather local exhaust systems discharging to the outdoor air add to the general room ventilation which provides employee comfort. Conversely, recirculation of air from process exhausts during warm weather not only robs the workroom of this inherent comfort ventilation but also adds to the workroom all the heat, smoke and odors dissipated in the workroom by both workers and processes at a time when they are most objectionable to workmen. Consequently, there should be a really compelling reason before any factory should permit recirculation from an industrial exhaust system at times when no heat saving is thereby achieved.

## On-Off Recirculation

A fairly obvious way of controlling recirculation so that it occurs only when a heat saving can be obtained is to have the discharge duct from the fan or separator of each exhaust system terminate in a Y-connection, one arm of which discharges to the outer air, the other arm of which recirculates to the workroom. A damper in the Y-fitting, when thrown in one direction, will close the recirculating discharge and send 100 percent of the effluent to the outdoor air. Conversely, at its other extreme position the damper will recirculate 100 percent of the effluent by closing off the discharge to the outdoor air. Although control of this damper can be manual, it should preferably be actuated automatically by a damper motor. This motor can be controlled as an on-off type control by an outdoor temperature thermostat set so that whenever the outdoor temperature exceeds the inside design temperature $T_1$ all effluent is discharged to the outdoor air and at all lower temperatures there is 100 percent recirculation.

However, caution must be observed in recirculating industrial effluents from a separator in all cases where failure of the separator will allow an increased workroom air contamination over that assumed in the original system design. A separator may allow excessive contamination to reach the workroom by virtue of lower actual separator efficiency than that assumed in its original choice, by faulty maintenance, or by changes in the nature and quantity of contaminants produced by the process. Since these two latter factors may occur even in systems whose initial performance was perfect, it is, in general, desirable to minimize the possibility of trouble due to these factors by recirculating as little process exhaust as possible and by discharging as much as possible to the outdoor air.

The simplest way to accomplish the objective of recirculating as little process exhaust as possible, while still meeting the demand for savings in heat and in size of heating plant, is to use an on-off type of control such as has already been described but to set the recirculation control at a temperature $T_2$ lower than the inside design temperature $T_1$ instead of at the latter temperature as in the previous case. This practice can be justified not only on the possibility of partial separator failure but also on the basis of minimizing the build-up of smoke and odor in the workroom and on the esthetic desirability

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†Presented at the 1950 Annual Meeting of the *American Industrial Hygiene Association*, Hotel Sherman, Chicago, Ill., April 27, 1950.

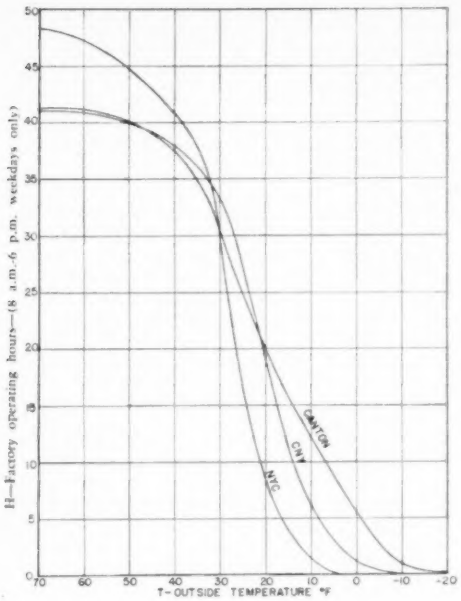



Fig. 1—Factory operating hours per year at various outside temperatures for New York City (NYC), Central New York (CNY) and Canton

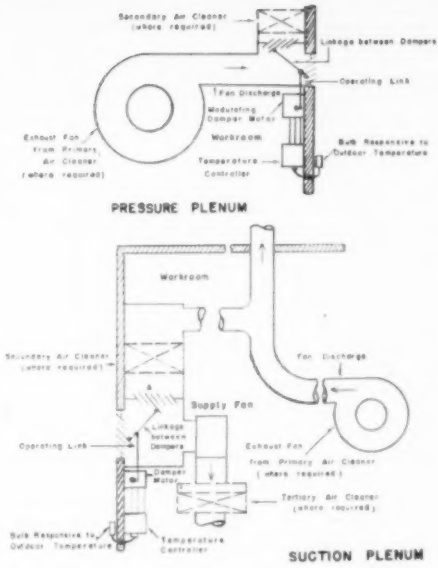



Fig. 2—Diagram of pressure and suction plenum systems with modulating control

(a) Pressure plenum: discharge damper set into building wall and damper to room discharging directly from plenum to room, (b) suction plenum: make-up air inlet remote from discharge to prevent short circuiting.

Applies to Pressure Plenum: Note: Make-up air to enter room through inlet duct equipped with thermostatically controlled tempering coil to maintain make-up air temperature.

Applies to Suction Plenum: Note: When damper A is completely closed, the supply fan can be automatically or manually shut down and make-up air admitted to the room through open doors, windows or louvers.

of supplying outdoor air whenever feasible.

In the analysis of the effect of using a recirculation control temperature $T_A$ lower than the inside design temperature $T_1$, and in the other somewhat different analyses to follow, the nomenclature employed is that listed at the end of the paper. These analyses depend upon $H$, the number of factory operating hours during the year having temperature $T$. Thus, if $H$ is defined as it was for the purpose of preparing tables and charts for this paper, as including only the hours from 8 a.m. to 6 p.m. on weekdays, it might be found, for instance, that for $T = 42$ F there were 40 hr on weekdays from 8 a.m. to 6 p.m. during the year 1947 having that temperature in the city of Syracuse, New York: *i.e.*, for this particular condition, $H = 40$. However, innumerable other definitions of factory operating hours can be used equally well. For instance, it could be considered as 8 a.m. to 6 p.m., seven days a week, or as 24 hr per day, seven days a week. It will be noted that in this latter case, it is possible to use a degree-day type of analysis by working with mean daily temperatures instead of mean hourly temperatures as is done throughout this paper. Thus, the term $D$ (days) can be substituted for $H$ (hours) in any equation in which the latter appears, although with much less precision in the results.

## Factory Operating Hours

Factory operating hours $H$ on the 8 a.m.-6 p.m. weekday only basis, were tabulated from Weather Bureau records for 1946, 1947 and 1948 for each of eight weather stations reporting in New York State, namely, Albany, Binghamton, Buffalo, Canton, New York, Oswego, Rochester and Syracuse, for all hours having mean hourly temperatures below 70 F. Only hours having temperatures below 70 F were tabulated because 70 F is the highest inside design temperature usually encountered. For each station the tabulated values of $H$ for each temperature for the three years were averaged to obtain an average value of $H$ for each temperature for each station. The values of $T$ and the corresponding average values of $H$ for each station were plotted on linear coordinates and the best smooth curve fitted to each. A study of these smooth curves showed that those for Albany, Binghamton, Buffalo, Oswego, Rochester and Syracuse were sufficiently similar to

justify their replacement by one typical Central New York curve (CNY in Fig. 1) representative of them all. The smooth curves plotted from the New York City and Canton three-year average data are also shown on Fig. 1. Subsequent calculations are based on values of *H* taken from Fig. 1. By so doing the same result is achieved as if longer term averages had been employed.

Based upon Fig. 1 data, Table 1 has been prepared to allow the evaluation of percent annual recirculation obtained in Central New York with on-off type control. The second column in Table 1 lists the cumulative sum of the hours shown in Fig. 1 for Central New York from the lowest temperature recorded $T_t$ to the recirculation control temperature $T_A$. A similar tabulation can be prepared for any community for which Weather Bureau data are available. By dividing the values in this table by 26 (since there are 2600 factory hours per year on the 8 a.m.-6 p.m. weekdays-only basis and this must be divided by 100 to express the result on a percentage basis), the percent of annual factory operating hours during which air is recirculated is obtained. As an example of its use, the tabular value for $T_A$ = 40 F for Central New York is 804.55 hr. The annual recirculation therefore is 804.55 ÷ 2600 = 30.9 percent. This means that if on-off recirculation control is based upon a 40 F control point in Central New York, air will recirculate 30.9 percent of the working time and will be discharged out of doors 69.1 percent of the time. In comparison with 100 percent recirculation through the year, this 69.1 percent represents a net gain by providing a better working environment for the workman.

Another example would be the case where the recirculation control temperature $T_A$ is made equal to the inside design temperature $T_1$. From Table 1 it will be seen that when these temperatures are 60 F, there are 1601.25 hr of recirculation in Central New York when *H* is on the 8 a.m.-6 p.m. weekdays-only basis. This is equivalent to 61.6 percent annual recirculation. Thus by comparison with control at 40 F, it can be seen that a decrease in control temperature of 20 F in this case cuts the percent annual recirculation almost in half.

## Heat Savings

Heat savings are the Btu per year required per cubic foot of exhaust fan capacity per minute with on-off control subtracted from the Btu per year per cubic foot which would have been required to heat 100 percent make-up air to replace all the air discharged if there were no recirculation. The percentage of heat saving is the percentage that the foregoing saving is of the latter value of Btu per year which would have been required to heat 100 percent make-up air if there were no recirculation. This percentage†† is:

$$S_2 = 100 \frac{\sum_{T_t}^{T_A} KH(T_A - T)}{\sum_{T_t}^{T_1} KH(T_1 - T)} \quad \cdots\cdots (1)$$

Both the numerator and the denominator of this equation have been evaluated for inside design temperature $T_1$ = 50, 55, 60, 65 and 70 F for Central New York, for *H* on the 8 a.m.-6 p.m. weekdays only basis, and presented in the five columns on the right side of Table 1. The denominator of Equation 1 is the underlined number at the top of the appropriate column in Table 1.

As an example of the use of these columns, the values of Btu saving and Btu that would have been required for a recirculation control temperature $T_A$ of 40 F, and an inside design temperature $T_1$ of 60 F for Central New York are 28,036.7 and 36,075.5, respectively, and 100 times their ratio equals 78.0. This means that under the same conditions that were previously shown to result in 30.9 percent net annual recirculation there is an annual heat saving of 78.0 percent of the heat that would have been exhausted had there

**Table 1—Data for Computing Annual Recirculation and Heat Saving with On-Off Control for Central New York Based upon *H* on 8 a.m. - 6 p.m. Weekdays Only Basis**

| Outside Temperature above which all exhaust is discharged and below which all is recirculated | Annual Recirculation | Heat Saving | | | | |
|---|---|---|---|---|---|---|
| | Annual factory hours having temperature below $T_A$ | Btu per (year) (cubic foot) (minute) of exhaust capacity saved by on-off recirculation control at $T_A$ from that required for 100% discharge at all temperatures. (K = 1.08) | | | | |
| $T_t$ | $\sum_{T_t}^{T_A} H$ | $\sum_{T_t}^{T_A} KH(T_A - T)$ | | | | |
| | | Inside Design Temperature $T_1$ (Fahrenheit) | | | | |
| Fahrenheit | Hours | 50 | 55 | 60 | 65 | 70 |
| 70 | 2010.95 | | | | | 55,352.5 |
| 65 | 1805.95 | | | | 45,185.8 | 54,142.1 |
| 60 | 1601.25 | | | 36,075.5 | 44,743.2 | 53,394.9 |
| 55 | 1397.65 | | 28,115.2 | 35,678.8 | 43,204.2 | 50,356.4 |
| 50 | 1196.15 | 21,228.4 | 27,680.0 | 34,156.0 | 40,390.6 | 47,059.6 |
| 45 | 997.85 | 20,801.4 | 26,182.0 | 31,588.8 | 36,948.9 | 42,347.6 |
| 40 | 804.55 | 19,343.4 | 25,674.2 | 28,036.7 | 32,355.6 | 36,710.0 |
| 35 | 618.55 | 16,936.1 | 20,262.5 | 25,616.3 | 26,939.4 | 30,279.6 |
| 30 | 442.75 | 15,708.0 | 16,092.6 | 18,491.7 | 20,872.0 | 23,264.0 |
| 25 | 287.05 | 10,018.7 | 11,564.2 | 13,124.1 | 14,672.8 | 16,210.5 |
| 20 | 165.55 | 6,505.3 | 7,381.4 | 8,278.1 | 9,178.8 | 10,061.0 |
| 15 | 86.25 | 3,779.6 | 4,228.8 | 4,695.7 | 5,174.2 | 5,631.9 |
| 10 | 40.45 | 1,943.6 | 2,161.7 | 2,379.1 | 2,613.5 | 2,818.5 |
| 5 | 15.95 | 837.6 | 925.1 | 1,010.7 | 1,090.7 | 1,183.4 |
| 0 | 5.15 | 294.1 | 322.8 | 350.6 | 378.4 | 406.2 |
| —5 | 1.40 | 85.5 | 93.7 | 101.2 | 108.9 | 116.4 |
| —10 | .15 | 9.7 | 10.6 | 11.3 | 11.9 | 15.0 |

**Table 2—Percent Saving in Required Heating Plant Capacity for On-Off Recirculation Control**

(Outside design temperature ($T_H$) = 0 F

| $T_A$ | Percent Saving in Required Heating Plant Capacity | | | | |
|---|---|---|---|---|---|
| | $T_1$ (Fahrenheit) | | | | |
| Temp. F | 50 | 55 | 60 | 65 | 70 |
| 50 | 100 | 91 | 83 | 77 | 72 |
| 40 | 80 | 73 | 67 | 62 | 57 |
| 30 | 60 | 55 | 50 | 46 | 43 |
| 20 | 40 | 36 | 33 | 31 | 29 |
| 10 | 20 | 18 | 17 | 15 | 14 |

†† The derivations of the various equations used are available from the authors. They have been omitted to conserve space.

been 100 percent make-up air. When the recirculation control temperature $T_A$ is made equal to the inside design temperature $T_1$, the heat saving is 100 percent. It has already been shown that when this occurs, there is 61.8 percent net annual recirculation.

### Savings in Make-Up Air Heating Plant

In the factory having an existing heating plant, the problem is that of determining the lowest value of recirculation control temperature $T_A$ that can be used with the existing plant. In the factory being constructed or expanded the problem is to determine the size of heating plant required for the chosen value of $T_A$.

It can be shown that the percentage of saving $S_3$ in size of heating plant required for make-up air, with on-off control as compared to that required for 100 percent discharge of make-up air to the outside, is:

$$S_3 = \frac{100(T_A - T_B)}{(T_1 - T_B)} \quad \ldots\ldots\ldots\ldots (2)$$

in which $T_A$ is the recirculation control temperature, $T_1$ is the inside design temperature and $T_B$ is the outside design temperature. It will be noted that insofar as this expression is independent of $H$, its evaluation (Table 2) applies to all definitions of $H$.

As an example of the use of this equation and of Table 2, take the case of Central New York with $T_1$ = 60 F and $T_B$ = 0 F. Then, for the case where $T_A$ is already chosen as 40 F, Equation 2 has a value of 67 percent which means that a heating plant only 33 percent as large as that required to heat make-up air without recirculation need be provided. As another example, assume that in an existing factory the extent of the anticipated maximum make-up air heating load and of the heating plant capacity available for this purpose have both been calculated and the latter shown to be 70 percent of the former. Then, by solving Equation 2 for $T_A$ for the condition of percent saving in plant capacity equal to 30 percent, $T_1$ = 70 F and, for instance, $T_B$ = 0 F, the minimum control temperature may be found as 21 F.

As would be expected, when $T_A$ = $T_1$, there is 100 percent saving in required heating plant capacity.

### Modulating Control

A modulating type of control is one which employs a damper motor-outdoor thermostat combination capable of holding the recirculation control damper or dampers in any position intermediate between all-on and all-off; the actual position being proportional to the outdoor temperature. The result achieved is a control having 100 percent discharge to the outdoor air at all outdoor temperatures above $T_3$ (the outdoor temperature for zero percent recirculation) and having 100 percent recirculation at all outdoor temperatures below a lower temperature $T_2$, which may or may not be chosen the same as the outdoor design temperature $T_B$. Between these extremes percent recirculation may either be a linear or non-linear function of temperature, depending upon the damper and plenum combination.

Modulating control systems take two general forms, the pressure and the suction plenum types (Fig. 2). These plenums are essentially chambers having two dampers, one set into the building wall and the other discharging into the room, both dampers being linked together so that one opens at the same rate that the other closes. When multiple leaf dampers are used, a transformation section must precede the plenum to reduce air velocity to the 1000 fpm range for which commercial leaf dampers are designed. When radial-vane and other more rugged damper types are used, a high velocity may be used if a damper motor of sufficient power is available, otherwise air velocity must be reduced to the point where the pressure load on the damper is low enough for a commercially available damper motor to operate the dampers.

When a suction plenum, as shown in Fig. 2 (b) is used, the make-up air inlet should be as far removed as possible from the discharge to the outer air to avoid short circuiting (*i.e.*, unintentional recirculation) from discharge to inlet. This requires that either the plenum be mounted near the discharge point and a long duct run from the plenum to the air inlet, or that the plenum be mounted near the air inlet and a long duct run from the plenum to the discharge. The latter is the preferred arrangement because it introduces the unavoidable additional resistance into the recirculation duct rather than into the outdoor air duct, thereby insuring that any deviation from predicted design conditions will be on the safe side and result in providing less rather than more recirculation. Because of the effect of the added resistance of the recirculating duct, suction plenum systems having this feature can be expected to show somewhat lower net annual recirculation and heat savings than pressure plenum systems having the same control temperatures.

The effect of adding a secondary air cleaner in the locations indicated in Fig. 2 is to increase the resistance to recirculating air flow and thereby decrease the percentage of recirculation for any given damper setting unless a compensating resistance to flow is added in series with the damper to the outside atmosphere. An elbow, a screen or other means of protecting this latter damper from the direct effects of wind, rain, birds and debris may constitute all or part of this compensating resistance. However, if the secondary air cleaner is a filter whose resistance increases as it gets dirty, the percentage of recirculation will decrease for any given damper setting as the filter gets dirtier regardless of any fixed resistance added in series with the outside air damper. Therefore, the use of a filter type secondary air cleaner adds a factor of safety to dust exhaust recirculating systems in that it automatically decreases the percentage of recirculation in inverse proportion to the efficiency of the primary air cleaner. To the extent that the suction plenum system also allows the use of a tertiary stage of air cleaning, it is to be preferred to the pressure plenum system.

An example which may be cited is that of a plant where the dust-laden air from the process equipment is first passed through a conventional centrifugal industrial dust collector on the suction side of the exhaust fan, then through a secondary cloth type dust arrester in the suction plenum before being introduced along with some outside make-up air to the supply fan. The supply system contains a tertiary air cleaner.

### Percent Recirculation

There are commercially available combinations of outdoor thermostats and damper motors which will position a damper so that the percentage of full angular rotation is a linear function of outdoor temperature.* Flow through control dampers is, unfortunately, not a linear function of damper rotation. Where desired, it is possible to offset this by introducing into the control mechanism a predetermined non-linearity of response calculated to equalize the non-linear relationship between damper setting and air flow. (In temperature controller-damper motor combinations which employ a Wheatstone bridge, this could be accomplished by non-uniform winding of the controller potentiometer, the motor balancing potentiometer or both. Such windings are not commercially available at present, but could be made in the electrical shop from regular commercial models.)

Where $Y$, the percent recirculation at temperature $T$, and $Z$, the percent discharge at temperature $T$, are not linear functions of $T$, it can reasonably be assumed that a control mechanism will be used in which angle of damper rotation, $\alpha$, is a linear function of $T$. Therefore, by determining the empirical relation between $Y$, $Z$ and $\alpha$, the empirical relation between $Y$, $Z$ and $T$ becomes known. Fig. 3 is typical of such relationships.

Where $Y$ and $Z$ are assumed to be linear functions of $T$, by definition:

$$Y = \frac{100(T_3 - T)}{(T_3 - T_2)} \quad \text{.....(3)}$$

$$Z = \frac{100(T - T_2)}{(T_3 - T_2)} \quad \text{.....(4)}$$

By multiplying $Y$ and $Z$ by $(H/100)$, a concept of *equivalent hours* of recirculation $(HY/100)$ and of discharge $(HZ/100)$, respectively, is obtained. During an hour when the dampers are set to discharge 25 percent of the exhaust system effluent and to recirculate 75 percent there would be 0.25 equivalent hours of 100 percent discharge and 0.75 equivalent hours of 100 percent recirculation. If *equivalent hours* always refers to equivalent time for 100 percent discharge, or recirculation, the preceding may be termed 0.25 hr of discharge and 0.75 hr of recirculation.

Since there is 100 percent recirculation at all temperatures below $T_2$ and 100 percent discharge at all temperatures above $T_3$, it follows that for the entire temperature range from $T_4$ to $T_5$:

Total annual hours of recirculation =

$$\sum_{T_4}^{T_3} \frac{HY}{100} + \sum_{T_3}^{T_5} H \quad \text{.....(5)}$$

Total annual hours of discharge =

$$\sum_{T_2}^{T_3} \frac{HZ}{100} + \sum_{T_3}^{T_5} H \quad \text{.....(6)}$$

The values of $Y$ and $Z$ from Equations 3 and 4 can be substituted in these equations when $Y$ is assumed to be a linear function of $T$.

Equations 5 and 6 have been evaluated in Table 3 for Central New York for a limited number of recirculation schedules, for 100 percent recirculation at the outside design temperature and with other assumptions as previously stated. The values of percent annual recirculation have been plotted in Fig. 4 to allow intermediate values to be approximated by interpolation. Although Fig. 4 is based primarily upon Central New York data, it may be used as a guide to the behavior of schedules for other temperature zones if it is borne in mind that the Central New York data represent an average of 6891 degree days; New York—5280 degree days, and Canton—8305 degree days.

### Heat Saving

Heat saving is obtained for modulating control by evaluating either of the following equations for the saving $S_1$ in Btu per year per cubic foot of exhaust capacity per minute (per hour or per day) for modulating control between the limits of $T_2$ and $T_3$ from that required for 100 percent discharge at all temperatures:

$$S_1 = \sum_{T_4}^{T_3} \frac{KHY(T_1 - T)}{100} + \sum_{T_3}^{T_5} KH(T_1 - T) \quad \text{.....(7)}$$

or

$$S_1 = \sum_{T_4}^{T_5} KH(T_1 - T) - \sum_{T_2}^{T_3} \frac{KHZ(T_1 - T)}{100} \quad \text{.....(8)}$$

The values of $Y$ and $Z$ from Equations 3 and 4 can be substituted in these equations when $Y$ is assumed a linear function of $T$.

For 100 percent recirculation at the outside design temperature, the saving in Btu per year per cubic foot of exhaust fan capacity per minute is listed for Central New York in Table 4. The previous conditions that $Y$ is assumed a linear function of $T$ and that $H$ is on the 8 a.m.-6 p.m. weekdays-only basis, also apply to this Table 4. The heat saving in percent is obtained by dividing any appropriate value of heat saving in Btu per year from Table 4 by the corresponding amount of heat in Btu per year that would have been re-

*When the damper motor has full stroke rotation in excess of 90 deg and the damper requires 90 deg rotation from full open to full closed, this cannot be achieved by the customary linkage connection between them, since this linkage introduces a deviation from linearity. However, by reducing the effective full stroke rotation of the damper motor to 90 deg, as for instance gearing it to a counter-shaft and taking the link motion from the counter-shaft, the rotation of the damper may be kept a linear function of temperature.

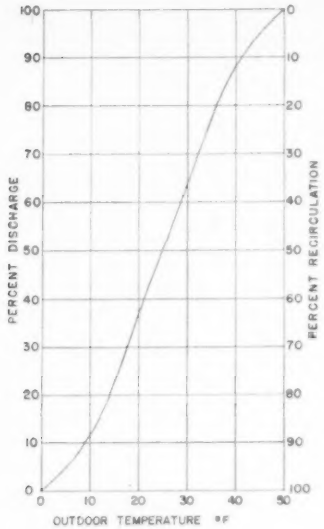



Fig. 3—Division of flow from plenum by two 6-blade multiple leaf louver dampers

(Without dividing partitions. One damper opening while the other is closing. Angle of opening of one damper being 90 deg minus angle of opening of the other.)

Uniform temperature scale (0 F — 50 F) substituted for 0 — 100 percent damper rotation scale. Percent discharge and recirculation calculated from equation:

$$\frac{q}{Q} = \frac{1}{1+\left(\frac{C_2 A_2}{C_1 A_1}\right)}$$

where

$Q$ = total air flow into plenum.
$q$ = flow through damper.
$C$ = coefficient of flow through the damper for any given angular setting of the damper.
$A$ = percent of total area of duct open to flow at the same angular setting of the damper.

Subscripts 1 and 2 denote damper 1 and damper 2. Values of $C$ and $A$ taken from Dicky and Coplen*.

quired to heat 100 percent make-up air at all temperatures and which is equal to the appropriate underlined number in Table 1. The result is then multiplied by 100 to obtain a percentage. These percentages have been plotted in Fig. 5 to allow interpolation of values not listed in Table 4.

## Heating Plant Savings with Modulating Control

It can be shown that when the percent discharge ($Z$) is a linear function of temperature $T$ and when the temperature $T_3$ for zero percent recirculation is greater than one-half the sum of inside design temperature $T_1$ and outside temperature $T_2$ for 100 percent recirculation, the percentage of saving $S_3$ in required make-up air heating plant is:

$$S_3 = 100 \times \frac{(T_1 - T_\theta) - \frac{1}{T_3 - T_\theta}\left(\frac{T_1 - T_\theta}{2}\right)^2}{T_1 - T_\theta} \quad \text{.....(9)}$$

When $T_3 = (T_1 + T_2)/2$, Equation 9 reduces to:

$$S_3 = 100\left(\frac{T_3 - T_\theta}{T_1 - T_\theta}\right) \quad \text{.....(10)}$$

When $T_3$ is less than $(T_1 + T_2)/2$, the percent saving in required make-up air heating plant is determined by Equation 10 and *not* Equation 9.

When $T_2 = T_B$, Equation 9 reduces to

$$S_3 = 100 - \frac{25(T_1 - T_\theta)}{(T_3 - T_\theta)} = 100 - \frac{25(T_1 - T_\theta)}{(T_3 - T_\theta)} \quad \text{.....(11)}$$

which is valid when $T_3$ is greater than $(T_1 + T_B)/2$.

These latter expressions, which are independent of $H$, have been evaluated, tabulated in Table 5 and plotted in Fig. 6.

## Comparison of On-Off and Modulating Control

The modulating control example shown in Table 6 (Central New York—$T_1$ = 60 F; $T_3$ = 50 F; $T_2$ = $T_B$ = 0 F; $H$ on an 8 a.m.-6 p.m. weekdays only basis) has been evaluated both using Fig. 3, as representative of the case where $Y$ and $Z$ are not linear functions of $T$, and using Tables 3, 4, and 5, which are based upon the assumption that $Y$ and $Z$ are linear functions of $T$. The on-off control example in Table 6 has been evaluated for $T_A$ = 25 F and 40 F, respectively.

Table 6 shows that where dampers having characteristics similar to six-blade multiple louvers are employed in modulating control pressure type plenums, their overall response is closely approximated by equations

Table 3—Equivalent Annual Factory Hours Recirculated and Their Percentage of Total Annual Factory Hours.

(Modulating control. $H$ based on 8 a.m. to 6 p.m. weekdays only; $Y$ is assumed a linear function of $T$; $T_2 = T_B$ for Central New York)

| Outside Temperature (F) | | Equivalent annual factory hours recirculated | Percent annual recirculation (on basis of 2600 factory hours per year) |
|---|---|---|---|
| $T_2$ | $T_3$ | $\sum \frac{T_{3-T_2}}{T_3-T_2}$ | |
| 0 | 50 | 392.72 | 15.1 |
| 0 | 40 | 245.92 | 9.46 |
| 0 | 30 | 127.05 | 4.88 |
| —5 | 50 | 357.12 | 13.73 |
| —5 | 45 | 284.65 | 10.95 |
| —5 | 35 | 159.66 | 6.14 |
| —5 | 25 | 69.53 | 2.68 |
| —10 | 50 | 327.48 | 12.6 |
| —10 | 40 | 196.97 | 7.58 |
| —10 | 30 | 95.5 | 3.68 |
| —10 | 20 | 34.64 | 1.33 |

and tables based upon the assumption that $Y$ is a linear function of $T$. This means that once tables based upon this assumption are evaluated for any geographical area, they may, for all practical purposes, be used to predict modulating control performance without the necessity of resorting to an empirical solution of each problem.

The explanation of the fact that use of Fig. 3 gives a lower percent

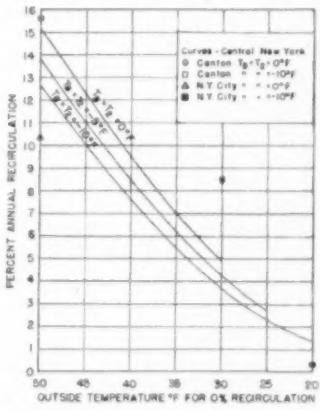



Fig. 4—Percent of annual factory hours recirculated for various recirculation schedules

Modulating control: $Y$ assumed a linear function of $T$.
Factory operating hours $H$: 8 a.m.-6 p.m. weekdays only.

*A Study of Damper Characteristics, by P. S. Dicky and H. L. Coplen (*ASME Transactions*, Vol. 64, February 1942, pp. 137-154)

Table 4—Heat Saving for Central New York in Percentage and in BTU per Year per Cubic Ft of Exhaust Capacity per Minute for Modulating Control

$H$ on 8 a.m.-6 p.m. weekdays-only basis; $T_2 = T_R$; $Y$ assumed a linear function of $T$

| Outside Temperature (F) | | Heat Saving—Btu* | | | | | Heat Saving-Percent | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $T_1$ (Fahrenheit) | | | | | $T_1$ (Fahrenheit) | | | | |
| $T_2$ | $T_3$ | 70 | 65 | 60 | 55 | 50 | 70 | 65 | 60 | 55 | 50 |
| 0 | 50 | 18680 | 16590 | 14540 | 12400 | 10240 | 53.8 | 56.7 | 40.3 | 44.1 | 48.2 |
| 0 | 40 | 13020 | 11740 | 10360 | 9010 | 7750 | 25.5 | 26.0 | 28.7 | 32.0 | 36.4 |
| 0 | 30 | 7460 | 6590 | 6410 | 5480 | 4730 | 13.5 | 14.6 | 17.8 | 19.5 | 22.2 |
| —5 | 50 | 17110 | 15190 | 13260 | 11260 | 9350 | 30.9 | 33.6 | 36.8 | 40.1 | 44.0 |
| —5 | 45 | 14260 | 12640 | 11310 | 9680 | 8190 | 25.8 | 27.9 | 31.4 | 34.5 | 38.5 |
| —5 | 35 | 8960 | 7690 | 7310 | 6250 | 5520 | 16.2 | 17.4 | 20.3 | 22.2 | 25.9 |
| —5 | 25 | 4460 | 3790 | 3660 | 3250 | 2850 | 8.0 | 8.4 | 10.1 | 11.5 | 13.4 |
| —10 | 50 | 15660 | 13890 | 12110 | 10360 | 8540 | 28.3 | 30.8 | 33.6 | 36.9 | 40.1 |
| —10 | 40 | 10020 | 9390 | 8400 | 7260 | 6180 | 18.1 | 20.8 | 23.3 | 25.9 | 29.0 |
| —10 | 30 | 4660 | 5140 | 4720 | 4080 | 3580 | 10.2 | 11.4 | 13.1 | 14.5 | 16.8 |
| —10 | 20 | 2410 | 2090 | 2060 | 1660 | 1530 | 4.3 | 4.6 | 5.7 | 5.9 | 7.2 |

*

$$Z = \sum_{T_2}^{T} \left[ \frac{KH(T_2 - T)(T_3 - T)}{T_3 - T_2} \right] + \sum_{T_3}^{T_2} KH(T_2 - T)$$

$K = 1.08$

Table 5—Percentage of Saving in Required Heating Plant for Heating Make-Up Air

Modulating control. $T_2 = T_R$; $Z$ assumed to be a linear function of $T$

| Outside Temperature (F) | | Percent Saving in Required Heating Plant Capacity | | | | |
|---|---|---|---|---|---|---|
| | | $T_1$ (Fahrenheit) | | | | |
| $T_2$ | $T_3$ | 70 | 65 | 60 | 55 | 50 |
| 0 | 50 | 65.0 | 67.5 | 70.0 | 72.5 | 75.0 |
| 0 | 40 | 56.2 | 59.4 | 62.5 | 65.7 | 68.8 |
| 0 | 30 | 42.8 | 46.2 | 50.0 | 54.2 | 58.4 |
| —5 | 50 | 65.9 | 68.2 | 70.5 | 72.7 | 75.0 |
| —5 | 45 | 62.5 | 65.0 | 67.5 | 70.0 | 72.5 |
| —5 | 35 | 53.1 | 56.7 | 59.4 | 62.5 | 65.7 |
| —5 | 25 | 40.0 | 42.8 | 46.2 | 50.0 | 54.2 |
| —10 | 50 | 66.6 | 68.7 | 70.8 | 72.9 | 75.0 |
| —10 | 40 | 60.0 | 62.5 | 65.0 | 67.5 | 70.0 |
| —10 | 30 | 50.0 | 53.1 | 56.2 | 59.4 | 62.5 |
| —10 | 20 | 37.5 | 40.0 | 42.8 | 46.2 | 50.0 |

recirculation, percent heat saving and heating plant saving than Tables 3, 4 and 5 is that, compared to response linear with $T$, an actual damper allows a lower percent recirculation in the range above 50 percent rotation (in this case between 25 F and 50 F), and an equally greater percent recirculation in the remaining 50 percent of its rotation (*i.e.*, between 0 and 25 F). Since there are more hours between 25 and 50 F than there are below 25 F, the result is a net lowering of total hours of recirculation. In the case of heat saving this effect is not so pronounced because hours above 25 F are weighted less by $(T_1 - T)$ than hours below 25 F. This same effect of weighting also operates to lower percent saving in required size of heating plant.

From Table 6 it will also be seen that for the same percent saving in size of required heating plant, modulating control yields a smaller percent annual recirculation than on-off control and a smaller percent heat saving. Similarly for the same percent heat saving, modulating control yields a smaller percent saving in required plant capacity than on-off control and almost the same percent recirculation. Finally, for the same percent recirculation, both modulating control and on-off control yield almost the same percent heat saving but modulating control allows a much larger saving in required plant capacity.

The primary criterion for guiding the choice of type of recirculation control and of control temperatures, is that percent annual recirculation should be as low as possible. Since it has been shown that by using modulating control, savings in excess of 60 percent of required plant capacity for heating make-up air, and savings in excess of 40 percent of heat that would have been exhausted can be obtained with net annual recirculation of under 15 percent, there seems to be very little justification for exceeding 15 percent net annual recirculation.

## Heat Saving

All discussion in this paper up to this point has been concerned with the method of controlling recirculation to effect heat and heating plant savings. It is even more important to determine when to employ these techniques. One reasonable criterion is to employ recirculation for heat or heating plant saving only when it relieves a hardship on management without imposing one on labor. On this basis the mere fact that an exhaust system is being installed and that the make-up air to replace that exhausted must be heated is not, of itself, sufficient justification to recirculate the system effluent. In the authors' opinion, such a hardship exists when the hourly amount of heat required for the exhausted air (on a day when the outside temperature equals the outside design temperature) exceeds 500,000 Btu per hour, or one-half the total of the hourly design transmission plus infiltration heat losses of the building, whichever is the greater. This is based upon the premises that (*a*) a hardship does not become real until it involves a substantial investment in equipment and a substantial cost of its operation, (*b*) factory heating systems can be reasonably expected to be large enough for a 50 percent overload to cover exhaust system heating needs, and (*c*) by confining recirculation to larger buildings, advantage may be taken of the greater dilution thereby achieved. These criteria based on heating capacity and heat savings are for recirculation to non-air conditioned areas. They do not apply to recirculation to air conditioned areas where humidity or temperature is precisely controlled, and secondary or tertiary air cleaners are included as part of the system.

## Air Concentration and Dust Count

An obvious possible recirculation criterion is the concentration in the

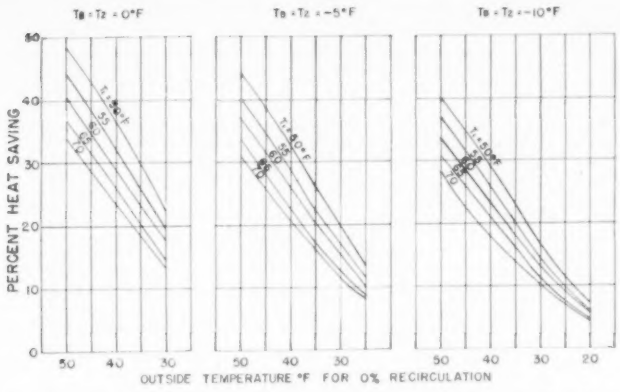



Fig. 5—Heat saving in percent of total heat that would be required to heat 100 percent make-up air

Central, New York

Modulating control: $Y$ assumed a linear function of $T$.

Factory operating hours $H$: 8 a.m.-6 p.m. weekdays.

workroom air of dust, gas or vapor resulting from such recirculation. When a maximum room air concentration or dust count can be agreed upon, it is reasonable to design and operate systems to maintain room concentrations below this maximum. However, this maximum may in many instances be well below the accepted *maximum allowable concentration* (MAC) for the substances in the air. One example of this would be a vapor having an accepted MAC considerably higher than its odor threshold concentration. In such a case, if an exhaust system discharging to the atmosphere would keep the workroom odor-free, there would be no justification for reintroducing the odor to the room and therefore recirculation should be limited to a percentage which will not allow the odor threshold to be exceeded.

Where recirculation is used primarily for heat and heating plant capacity saving, there is no valid reason for recirculation during non-heating days and, therefore, an air concentration criterion should be operative only during the heating season and, in the authors' opinion, only after the previously advocated criteria of hardship in providing heat and heating plant capacity have already been met. Hemeon[1] has published a method for predicting room air concentrations for gases and vapors; and Rowley and Jordan[2] have done the same for dusts. These predictions involve assumptions which are not valid in all cases. It is therefore necessary to make room air concentration measurements from time to time to be sure the design maximum room concentration is not being exceeded. Odor, smoke or high temperature in the workroom that can be eliminated by decreasing the percentage of recirculation, are obvious indications of excessive recirculation, and should be remedied immediately.

Many industrial operations produce both dust, smoke and an odorous vapor. When the exhaust from polishing, buffing, honing and similar operations passes through even a highly efficient dust separator, the effluent air frequently still carries the odor or smoke from the heated buffing compound or oil used. Because of this it is desirable to classify dust producing operations into *recirculation categories* depending upon the vapor, odor or smoke simultaneously produced. Thus, the exhaust from those operations which produce more vapor, odor or smoke than it would be practicable to remove by activated carbon, scrubbers or other means should be directed to dust collectors which discharge outdoors 100 percent of the time, regardless of the efficiency of the dust collector. Those exhausts which carry an amount of vapor, odor or smoke small enough to be practicably removed from the dust collector effluent should also be grouped and directed to dust collectors whose discharge is further treated before its use as recirculating air. Lastly, those exhausts which are substantially free of vapor, odor or smoke require only the use of an efficient

[1]Exponent numerals refer to References.

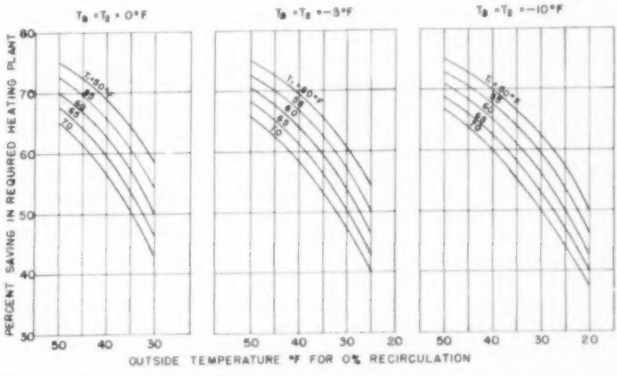



Fig. 6—Percent saving in required make-up air heating plant capacity for various schedules

Modulating control: percent discharge $Z$ assumed a linear function of $T$.

Table 6—Comparison of Modulating and On-Off Control

Central New York, $T_A$ = 60 F, $T_2$ = $T_R$ = 0 F, $T_2$ = 50 F. $H$ on 8 a.m.-6 p.m. weekdays-only basis.

| Control Conditions | Annual Recirculation Percent | Heat Saving Percent | Saving in Required Heating Plant Capacity Percent |
|---|---|---|---|
| Modulating: $Y$-$T$ Relation from Fig. 3 | 13.7 | 38.5 | 67.5 |
| Modulating: $Y$ assumed a linear function of $T$ | 15.1 | 40.3 | 70.0 |
| On-off — $T_A$ = 40 F | 30.9 | 78.0 | 66.7 |
| On-off — $T_A$ = 25 F | 11.0 | 36.5 | 41.8 |

dust collector to be available for use as recirculating air.

## Small Unit Dust and Mist Separators

In a previous paper[3] and in one recently published[4], the problems of recirculation from small unit dust and mist separators have been discussed and certain standards proposed. Separators of this class have a capacity of less than 1000 cfm per unit and therefore individually have a maximum hourly heat load of under 75,000 Btu per hr. They therefore do not individually meet the criteria suggested for determination of hardship in providing heat. It would, in fact, take a battery of five of the 1000 cfm units, ten of the 500 cfm units or twenty of the 250 cfm units to aggregate the suggested minimum of 500,000 Btu per hour, and an even larger number in large structures where the minimum exceeds 500,000 Btu per hour. Since there is seldom economic justification for installing large batteries of unit collectors rather than a few central exhaust systems, it seems quite improbable that many instances will arise where unit collector recirculation can be justified on the basis of hardship in providing heat.

Therefore, the use of recirculating unit separators would have to be justified on bases other than heat saving. Such bases do exist but they rarely justify the use of more than one, or two units per workroom. It has been found in the authors' general experience that small grinding operations and others of the type for which unit separators are usually employed are better controlled over a long period of time by removing the filtering element, where such exists, and piping the discharge out of doors. Where the discharge of such small operations is out of doors, either through a cyclone separator or through no separator, the system may be expected to operate at full design air flow for an indefinitely long period of time, whereas with the usual means of filtration provided in unit separators, it is almost a certainty that not long after installation air flow will be either nil or a small fraction of the design rating. In such cases it is most likely better public policy to discharge 100 percent of the design flow of a relatively dirty exhaust to the atmosphere than to reduce control velocities at hoods by from 50 to 75 percent in an effort to recirculate relatively clean exhaust air.

A control system which is capable of overcoming this dilemma is illustrated in Fig. 7. This system operates to provide a constant air capacity regardless of the state of maintenance of the air filter. As long as the filter is regularly and properly cleaned, the system operates with 100 percent recirculation. As the filter collects more dirt than that anticipated in the original system design, an increasing quantity of air is bled to the atmosphere, less is recirculated, but the total air flow remains constant.

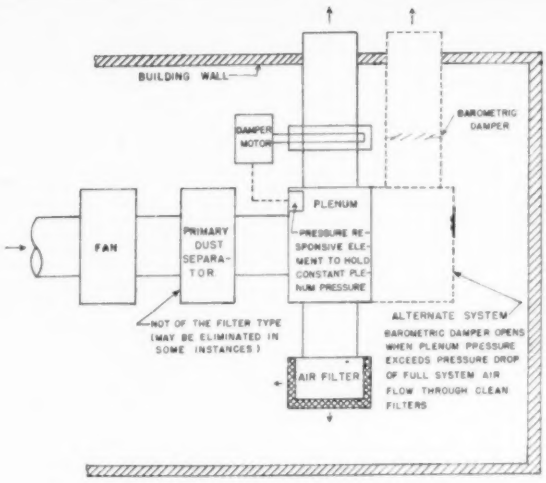

BUILDING WALL
DAMPER MOTOR
BAROMETRIC DAMPER
PLENUM
FAN
PRIMARY DUST SEPARATOR
PRESSURE RESPONSIVE ELEMENT TO HOLD CONSTANT PLENUM PRESSURE
NOT OF THE FILTER TYPE (MAY BE ELIMINATED IN SOME INSTANCES)
ALTERNATE SYSTEM
BAROMETRIC DAMPER OPENS WHEN PLENUM PRESSURE EXCEEDS PRESSURE DROP OF FULL SYSTEM AIR FLOW THROUGH CLEAN FILTERS
AIR FILTER

Fig. 7—Control system to provide constant air flow at hoods (Static pressure control of exhaust system recirculation.)

## Maintenance Factor

It is important to note that after all other criteria for recirculation have been satisfied there still remains the all-important factor of maintenance.

Without maintenance of a very high order, recirculation should never be attempted, either from large units or small ones; with control or without. Where a plant has an exhaust system maintenance program of the type characterized by regular weekly or monthly velocity and static pressure checks of each system, recirculation of large air volumes is most likely to be safe.

## Summary of Conclusions

1. There should be no recirculation of any process effluent which could be detrimental to the health and well-being of persons employed in the workroom.

2. For the same reduction in installed heating plant, a lower net annual recirculation can be achieved through the use of modulating control than by on-off control.

3. The use of secondary air cleaners of the filter type in modulating control systems adds a factor of safety and is recommended.

4. The suction plenum system of modulating control is preferable to the pressure plenum system because it allows a tertiary air cleaner to be used.

5. There is very little error in assuming that modulating recirculation control systems operate with percent recirculation a linear function of temperature.

6. There is very little justification for net annual recirculation in excess of 15 percent.

7. It is proposed that recirculation for purposes of heat saving be limited to exhaust heating loads in excess of 500,000 Btu per hour, or one-half the total hourly building transmission plus infiltration load, whichever is the greater.

8. There are very few instances in which recirculation from small unit separators is justifiable.

## References

1. Air Dilution in Industrial Ventilation, by W. C. L. Hemeon (*Heating and Ventilating*, November 1940, p. 39; December 1940, p. 42; March 1941, p. 71).

2. Predicting Dust Concentration, by F. B. Rowley and Richard C. Jordan (*Heating, Piping & Air Conditioning*, December 1940, p. 699; February 1941, p. 99; May 1941, p. 304).

3. Characteristics of Unit Dust Collectors, by Arthur C. Stern, Jack Baliff, Arthur E. Perina, Robert Crowley, Benjamin Feiner, and Arthur A. Urbano (ASHVE TRANSACTIONS, Vol. 52, 1946, p. 237).

4. Unit Acid Mist Separators for Plating Room Use, by Benjamin Feiner, William J. Burke, and Samuel Moskowitz (N.Y. State Dept. of Labor Monthly Reviews, Vol. 29, No. 6, June 1950).

## Nomenclature

$T$ = outside temperature, Fahrenheit.
$T_1$ = inside design temperature, Fahrenheit.
$T_2$ = outside temperature for 100 percent recirculation, Fahrenheit.
$T_3$ = outside temperature for 0 percent recirculation, Fahrenheit.
$T_4$ = lowest outside temperature recorded for location, Fahrenheit.
$T_5$ = highest outside temperature recorded for location, Fahrenheit.
$T_A$ = recirculation control temperature, the outside temperature above which all exhaust system effluent is discharged and below which it is recirculated, Fahrenheit.
$T_B$ = outside design temperature (*i.e.*, lowest outside temperature for which provision is made to heat air), Fahrenheit.
$H$ = factory operating hours during the year having mean hourly temperature $T$. (Any definition of operating hours can be used. The tables in this paper are based upon defining them as 8 a.m.—6 p.m. weekdays only.)
$D$ = days during the year having mean daily temperature $T$.
$K$ = a constant depending upon both specific heat of air and rate of air flow (specific heat of air (0.24) × density of air (0.075) × factor to convert from hourly basis.)
  $K$ = 0.018 when results are given per cubic foot of air per hour.
  $K$ = 1.08 when results are given per cubic foot of air per minute.
$K_1$ = the same constant when time is expressed in days $D$ instead of hours $H$
  $K_1$ = 0.018 when results are given per (cubic foot of air) (day).
  $K_1$ = 0.432 when results are given per (cubic foot of air) (hour).
  $K_1$ = 25.92 when results are given per (cubic foot of air) (minute).
$S_1$ = heat saving, Btu.
$S_2$ = heat saving, percent.
$S_3$ = saving in required heating plant capacity, percent.
$Y$ = recirculation at temperature $T$, percent.
$Z$ = discharge at temperature $T$, percent.
$\alpha$ = damper rotation angle, degrees.

## COOPERATIVE RESEARCH PROJECTS

The Society has completed arrangements for cooperative research in fundamental problems of heating, ventilating and air conditioning with seven colleges and universities, according to the announcement of Pres. Lester T. Avery. The research agreements for a one-year period are with the College of Medicine, University of Illinois, Case Institute of Technology, Kansas State College, Michigan State College, Cornell University, University of Minnesota, and the University of Florida. An eighth cooperative research project is in progress at Columbia University.

Under such agreements, a grant of funds is made by the Society to each institution which in turn utilizes its own laboratory facilities and faculty to perform the research under the direction of a Research Technical Advisory Committee.

Studies on the physiological adjustments of human beings to sudden changes in environment were started at the University of Illinois 11 years ago, the contract being renewed annually since then. Under the present renewal, Dr. Robert W. Keeton, head of the Department of Medicine, and his colleagues will concern themselves principally with physically impaired persons.

Studies on air flow from ceiling outlets will continue at the Case Institute of Technology, upon the recommendation of the TAC on Air Distribution of the ASHVE. This work is headed by Prof. G. L. Tuve, head of the Department of Mechanical Engineering at Case.

Further work at Kansas State College has also been recommended by the TAC on Air Distribution. The study of high velocity air as it is used in factories is a vital need of industry. These studies at Kansas State are considered fundamental in nature and vital to improvements in industrial ventilation. Prof. Linn Helander, head of the Department of Mechanical Engineering, is in charge.

At the request of Lorin G. Miller, dean of engineering at Michigan State College, the cooperative research plan for the study of air friction in fittings attached to rectangular ducts has been renewed without additional funds.

At Cornell University, C. O. Mackey, professor of heat-power engineering, will continue studies on the effect of size on readings of the sol-air thermometer. Professor Mackey said no additional funds were required in continuing the work.

Solar energy as a potential heat source for the heat pump is being studied at the University of Minnesota, with Dr. Richard C. Jordan, acting head of the Department of Mechanical Engineering, in charge.

A special research fellowship to carry on field studies on the control of panel heating systems was also established at the University of Minnesota. Under the direct supervision of A. B. Algren, head, division of heating, ventilating, air conditioning and refrigeration, Department of Mechanical Engineering, the fellowship will run until June 30, 1951.

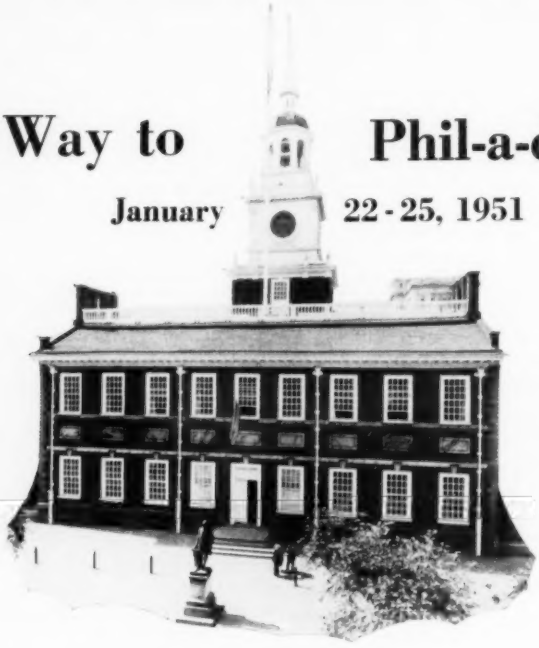
A new cooperative research project has been set up at the College of Engineering, University of Florida, under which the university will receive ASHVE assistance in carrying on investigations covering air entrainment in hot water systems.

At Columbia University radioactive salts are being used to study moisture distribution and migration, to provide data on heat transfer rates for ground coil evaporators for heat pump installations, with Prof. Carl F. Kayan in charge.

# On Our Way to Phil-a-del-phi-a!!

**January 22-25, 1951**

**57th Annual Meeting ASHVE**



**Headquarters Bellevue-Stratford Hotel**

Independence Hall

PLANS for welcoming the ASHVE members to Philadelphia for the 57th Annual Meeting of the Society and the 10th International Heating and Ventilating Exposition, which will be held during the week of January 22, 1951, have progressed rapidly during the past few weeks. The Committee on Arrangements of the Philadelphia Chapter looks forward to the largest meeting ever held by the Society because of the heavy advance reservations for hotel rooms in the various downtown hotels.

Registration will commence on January 21 at the Bellevue-Stratford Hotel, Broad and Walnut Sts. Technical sessions will be held on Monday, Tuesday, Wednesday and Thursday.

A get-together luncheon will be held at the Bellevue-Stratford on Monday at noon, with a speaker on matters of engineering interest.

### Exposition

The Exposition is scheduled to open at 2:00 p.m. on Monday at the Commercial Museum and will be open daily until 10:00 p.m. from Monday to Thursday and will close at 6:00 p.m. on Friday.

Among the subjects selected by the Program and Papers Committee for presentation at the technical sessions are, hot water costs, snow melting installations, heat pump operation and ground grid design, and earth heat exchangers. A symposium on physiological factors involving comfort and health is being scheduled. This session will cover physiological principles, requirements of comfort air conditioning for the prevention and treatment of diseases, and industrial hygiene. There will also be discussions on smoke measurement and combustion performance, air pollution and heat requirements of buildings.

Betsy Ross House

### Ladies' Features

Among the features for the ladies will be a get-together reception and tea on Sunday afternoon, January 21, afternoon and evening entertainment on Monday, a bus tour to historic places on Tuesday morning, a luncheon and fashion show on Wednesday and an opportunity to visit Philadelphia department stores during the week.

Plans are under way to have a post meeting cruise to Bermuda and Nassau, which will provide a week of rest and relaxation.

A special list for ladies will provide information on the main attractions in Philadelphia shops and department stores, antique shops, museums and institutions, churches, restaurants, and amusement places. There will also be tickets available for radio broadcasts and television shows.

A. J. Nesbitt, general chairman, and the members of his Committee on Arrangements expect to welcome a large crowd in Philadelphia and urge every member to make early hotel and transportation reservations. Further details about the program will be published, and reservation forms for the various entertainment events will come to members by mail.

The Philadelphia chapter wants all members to remember Philadelphia and the 57th Annual Meeting.

### Committee on Arrangements

A. J. Nesbitt
General Chairman

M. F. Blankin
Honorary Chairman

F. H. Buzzard
Vice Chairman

*BANQUET*—M. E. Barnard, *Chairman:* H. R. James, E. C. Lambert, C. J. Lubking, W. W. Malloy, H. H. Mather, G. W. Powell, Jr., G. E. Tuckerman, F. B. Wilder.

*ENTERTAINMENT*—E. K. Wagner, *Chairman:* R. H. Ackermann, R. J. Augusterfer, H. H. Erickson, H. J. Faltenbacher, H. W. Goldner, J. H. Hucker, R. F. Hunger, L. P. Hynes, M. G. Kershaw, R. S. Mizener, S. R. Nusbaum, F. F. Pfeiffer, A. M. Robertson, Karl Rugart, Edward Semel, R. J. Sigel, J. K. Walters.

*EXPOSITION*—C. F. Dietz, *Chairman:* C. G. Binder, H. W. Doerrfuss, C. J. Forve, Nicola Ginzburg, A. A. Granke, H. E. Grossman, J. E. Heim, J. J. Hucker, Jr., H. K. King, A. E. Kriebel, H. H. Mohrfeld, A. G. Mutimer, H. M. Parent, R. M. Sharp, G. F. Smith, W. D. Strause, H. N. Teuber.

*FINANCE*—A. C. Caldwell, *Chairman:* C. B. Eastman, Edwin Elliot, R. J. Lee, L. E. Moody.

*LADIES*—E. H. Dafter, *Chairman:* G. F. Bertrand, R. H. Smiles, *Assisted by:*—Mmes. R. S. L. Arnold, M. E. Barnard, G. F. Bertrand, M. F. Blankin, F. H. Buzzard, L. M. Church, W. P. Culbert, E. H. Dafter, C. F. Dietz, John Everetts, Jr., H. B. Hedges, J. H. Hucker, R. F. Hunger, M. G. Kershaw, J. O. Kirkbride, C. S. Leopold, Ludwig Mack, H. H. Mather, J. W. McElgin, L. E. Moody, A. J. Nesbitt, E. K. Wagner.

*PUBLICITY*—W. P. Culbert, *Chairman:* G. P. Alexander, A. E. D'Ambly, S. E. Plewes, R. D. Touton.

*RECEPTION*—J. O. Kirkbride, *Chairman,* L. M. Church, *Co-Chairman:* R. S. L. Arnold, T. J. Atkins, Lucien Buck, P. A. Cavanagh, S. E. Farrington, H. E. Gross, H. B. Hedges, A. H. Koch, James Marshall, H. G. McCullough, F. B. Millham, H. B. Prewitt, J. J. Quinn, R. P. Schoenijahn, W. S. Scott, C. D. Shields, Pierce Timmis, L. A. Tucker.

*SESSIONS*—John Everetts, Jr., *Chairman:* Alan Dombro, R. E. Sexton, M. A. Sheffler.

*TRANSPORTATION*—Isadore Director, *Chairman:* E. I. Curley, F. N. Darby, L. C. Davidson, J. E. Hutchison, Ludwig Mack, P. H. Yeomans.

"Queen of Bermuda"

## Cruise Schedule to Bermuda and Nassau

| | | |
|---|---|---|
| Jan. 27 | 3:00 p.m. | Lv. New York on the famous *Queen of Bermuda;* every room with private bath and toilet. |
| Jan. 28 | | At sea in the Gulf Stream |
| Jan. 29 | 7:00 a.m. | Ar. Bermuda and cruise along the charming North Shore into Hamilton Harbor, one of the loveliest in the world. |
| | 9:00 a.m. | Opportunity for delightful drives and sight-seeing. |
| | 3:00 p.m. | Lv. Bermuda. |
| Jan. 30 | | Again at sea. |
| Jan. 31 | 11:00 a.m. | Ar. Nassau and go ashore in this winter metropolis for sight-seeing, swimming, or other amusement. |
| | 11:30 p.m. | Sail from Nassau |
| Feb. 1-2 | | Two solid days of restful cruising with plenty of entertainment. |
| Feb. 3 | 9:00 a.m. | Ar. New York |

Members from the West and South can have their tickets routed via Philadelphia to New York. There is daily express train service between Philadelphia and New York every 30 minutes.

This cruise offers three options, any one of which may be exercised.

1. The entire cruise which will probably appeal to the greatest number.
2. Leave the cruise on arrival in Bermuda, January 29, lay over there until February 7, to return by the next regular sailing of the *Queen.*
3. Terminate the cruise in Nassau on arrival and return *via* Miami at your pleasure.

The minimum rate for two in a room would be $184.85 per person, including room with bath, all meals on the ship, and all taxes required by the U.S., Bermuda and Nassau Governments.

Additional information will be supplied to members and their friends upon request.

# NOMINEES FOR 1951 COMMITTEE ON RESEARCH

## (THREE-YEAR TERM)

*A. B. Algren*, head, Division of Heating, Ventilating, Air Conditioning and Refrigeration, Department of Mechanical Engineering, University of Minnesota, was born on October 14, 1893 in Minneapolis. Professor Algren graduated from the University of Minnesota in 1925, receiving a B.S. in mechanical engineering, and in 1931 received his M.S. in mechanical engineering.

He was associated with the Chicago, Milwaukee and St. Paul Railroad from 1912 until 1917, at which

A. B. Algren
Minneapolis, Minn.

time World War I broke out and Professor Algren served overseas with the United States Army. In 1925 Professor Algren joined the staff of A. T. Rydell, Sash and Door Co., as superintendent in charge of installing and repairing equipment. His first association with the University of Minnesota was as a research engineer in 1927-28. From 1928 to 1933 he was an instructor in mechanical engineering and assistant director of the Engineering Experiment Station. He became assistant professor in mechanical engineering in 1933, remaining assistant director of the Engineering Experiment Station, which positions he held until 1941. With the outbreak of World War II, Professor Algren served on the War Production Board in 1941 as assistant district representative of Training Within Industry in Minneapolis, and in 1942 until the end of the war in 1945, he served as Regional Chief of Training on the War Manpower Commission.

Professor Algren resumed his position with the University in 1945 as associate professor of mechanical engineering and assistant director of the Engineering Experiment Station until 1948 when he was appointed head of the Division of Heating, Ventilating, Air Conditioning, and Refrigeration, Department of Mechanical Engineering, the position he now holds.

Professor Algren is associated with the Minnesota Chapter of the Society, having served as its secretary, vice president, and president, in 1931, 1932, and 1933, respectively. In 1934 he served on the Chapter's Board of Governors. Also active in Society affairs, Professor Algren has served on the following Technical Advisory Committees: Heat Transmission, 1932-33; Glass, 1947-50; Panel Heating, *Group A*, 1947-50; Panel Heating, *Group D*, 1947-48; Panel Heating and Cooling, 1947-50. He also served on the Committee on Research from 1948-50 and on the Guide Publication Committee in 1948 and 1949, and now is serving as the chairman.

Professor Algren holds membership in the following societies: *American Society for Engineering Education; American Association of University Professors; Minnesota Association of Professional Engineers; Army Ordnance Association; Minnesota Federation of Architects and Engineers*. He is also a member of the *Minneapolis Engineers Club*; Sigma Xi and Pi Tau Sigma. He is listed in *Who's Who in Engineering, Who's Who in the Central States* and *American Men of Science* and is a registered professional engineer in the State of Minnesota.

*John Everetts, Jr.*, consulting engineer with Charles S. Leopold, Philadelphia, Pa., was born on March 14, 1905 in Brooklyn, N.Y. He attended Brooklyn Polytechnic

John Everetts, Jr.
Philadelphia, Pa.

Institute and graduated in 1929 with a degree in mechanical engineering.

Mr. Everetts was associated with W. L. Fleisher & Co., Inc., N.Y., from 1923-25 in the designing and testing field and remained with that company, while attending school, from 1926-29, working during the summer months only. Upon graduation he joined the Richardson & Boynton Co. of Dover, N.J., and was in charge of the research laboratory. He became secretary-treasurer of the Air & Refrigeration Corp., New York, N.Y., in 1933 and until 1938 was responsible for engineering and design of industrial and commercial air conditioning. After leaving the Air & Refrigeration Corp., he was employed as sales engineer with the

Frigidaire Division of General Motors Sales Corp., Dayton, Ohio, from 1939-41. The following year was spent as an engineer with Blaw-Knox Co., Blawnox, Pa. Mr. Everetts was commissioned a Lieutenant in the Naval Reserve in July 1942 and was assigned to duty in the Bureau of Ships, where he served as west coast representative of the Air Conditioning Section, handling all technical problems, as well as the distribution of equipment for heating, ventilating and air conditioning of naval vessels at all west coast activities. He was promoted to the rank of Lieutenant-Commander in 1944 and Commander in 1945. After his release to inactive duty by the Navy late in 1946, he formed a partnership with T. H. Urdahl—Urdahl & Everetts, consulting engineers, Washington, D.C., and San Francisco, Calif. He joined the staff of Charles S. Leopold as a consulting engineer in 1949.

Mr. Everetts has been a member of many of the Society's Research Technical Advisory Committees, among which are included the following: Refrigeration in Relation to Air Treatment—1934-36; Summer Air Conditioning for Residences—1937-41; Weather Design Conditions—1938-46; Cooling Load in Summer Air Conditioning—1938-44; Sensations of Comfort—1949-50; Panel Heating and Cooling—1950; member, Sorbents—1938-43 and chairman, from 1944-50. He served on the board of governors for the Golden Gate Chapter in 1947-48 and for the Washington, D.C. Chapter in 1949. In 1947 he served as the Golden Gate Chapter's alternate. Mr. Everetts is also a member of the *American Society of Refrigerating Engineers* and the Philadelphia Engineers Club.

He is the author of several technical papers and is a lecturer on the engineering staff at Columbia University.

*T. H. Smoot*, Director of Research, The Lennox Furnace Co., Marshalltown, Ia., was born on August 23, 1898 in Accoceek, Md. He graduated from the Catholic University of America in 1923, receiving a B.S. in mechanical engineering.

From 1923-24 he was chief draftsman and computer in the Municipal Architect's office, Washington, D.C., where he was engaged in the design of heating and ventilating systems for public schools. For the following three years he was supervising engineer for the Socony Burner Corp., New York City, where he was in charge of the application of

T. H. Smoot
Marshalltown, Iowa

oil burners and heating systems. He spent the next three years doing laboratory oil burner development work as assistant chief engineer for the Petroleum Heat and Power Co., Stamford, Conn. Mr. Smoot's next association was with Anchor Post Products, Inc. for a period of approximately 19 years, which also included the years of World War II, during which Mr. Smoot was also engaged in research in the field of combustion and heat transfer for specific armed forces applications with the College of Mechanical Engineering of Johns Hopkins University, Baltimore, Md. When Mr. Smoot joined The Lennox Furnace Co. in July 1949, he was vice president and chief engineer of Anchor Post Products, Inc.

Mr. Smoot joined the Society in 1935 and served as a member of the TAC on Fuels from 1941 until 1947 and as a member of the TAC on Combustion in 1948 and 1949, and is currently serving as that Committee's chairman. He is also a member of the *American Society of Mechanical Engineers;* Underwriters' Laboratories, serving on that association's Industry Advisory Committee on Oil Burners and Oil Burning Equipment; the *American Gas Association* and *Gas Appliance Manufacturers' Association*, serving on several of those associations' committees. Mr. Smoot was a member of the original committee that framed the U.S. Commercial Standards covering oil burner construction and performance and has retained his membership on that standing committee. He is a member of Sigma Xi and a registered professional engineer in the State of Maryland.

*T. A. Walters*, director of research, American Blower Corp., Detroit, Mich., was born on January 1, 1907 in Lexington, Ky. He attended the University of Kentucky, graduating with a B.S. in mechanical engineering in 1930.

Upon graduation, Mr. Walters joined the American Blower Corp. as a student engineer and has remained with the corporation since that time, a period of twenty years. After one

T. A. Walters
Detroit, Mich.

year with the corporation he was made a junior research engineer and in 1932-33 served the American Blower Corp. as a general research engineer.

Mr. Walters became a research laboratory supervisor in 1933 and was promoted in 1936 to assistant to the director of research. He retained that position until 1942 when he was appointed director of research, which position he now holds.

Joining the Society in 1944, Mr. Walters took an active interest in

Society affairs, serving on the TAC on Sound Control during 1944. He continued as a member of that committee in 1945 and 1946 and served as its chairman from 1947-50.

Mr. Walters is also a member of the *Acoustical Society of America.*

*W. N. Witheridge*, ventilation consultant, General Motors Corp., Detroit, was born on March 10, 1910 at Saginaw, Mich. He attended Michigan State College, receiving a B.S. in mechanical engineering in 1935; Harvard University, School of Public Health, receiving an S.M. in sanitary engineering in 1936; and the University of Michigan, Graduate School, receiving an M.S. in public health engineering in 1946.

From 1927-30 Mr. Witheridge was employed with General Motors, Saginaw Crankshaft Div., as a part-time machine and tool design engineer while attending General Motors Institute in Flint and with the Oldsmobile Div. of General Motors, Lansing, Mich., from 1930-36, working in machine and tool design, plant layout, process engineering and cost estimating. He joined the staff of

W. N. Witheridge
Detroit, Mich.

Harvard University from 1936-37 as a part-time instructor in industrial ventilation while doing research work and making field investigations in industrial ventilation. Mr. Witheridge was then associated with the Detroit Department of Health from 1937-46, in 1937 until 1941 as chief engineer of the Bureau of Industrial Hygiene and in 1941 he was appointed director of the Bureau. He was also employed part time from 1941-45 with the University of Michigan, Extension Service, conducting war training courses in air sanitation and industrial ventilation for the College of Engineering. In 1946 he returned to General Motors Corp. as ventilation consultant, the position he now holds.

Mr. Witheridge joined the Society in 1944 and served on the Special Survey Committee on Industrial Ventilation and the Committee for Cooperation with other Professional Societies in 1945. In 1947 he was a member of the TAC on Air Cleaning and chairman of the TAC on Industrial Ventilation in 1947-50. He was a member of the Guide Publication Committee in 1947 and 1948 and chairman of that committee in 1949. He also served on the TAC on Odors in 1949-50 and as the Michigan Chapter's representative on the Committee on the Promotion of Research in 1949.

Mr. Witheridge is listed in *Who's Who in Industrial Medicine* and in *Who Knows and What.*

# HONORED BY LIFE MEMBERSHIP

FRANK H. GAYLORD, Indianapolis, Ind., vice president, Hoffman Specialty Co. Mr. Gaylord was born in 1880 at Lincoln, Nebr. and attended school there. He began his professional experience with one year with C. A. Dunham Co., followed by five years with Western Supply Co., Lincoln, Nebr., where he was engaged in estimating and making heating layouts. During the following three years, Mr. Gaylord was employed with Spencer Heater Co. as the western branch manager and later as general sales manager of the Company's office in Scranton, Pa.

Mr. Gaylord's next association was with Hoffman Specialty Co., where he has remained for a period of nearly 25 years. Mr. Gaylord, aside from being vice president and director, has served that company in many capacities. For many years he made his headquarters in Chicago, directing sales activities on Hoffman products throughout the West.

F. H. Gaylord
Indianapolis, Ind.

After enjoying a brief period of retirement in 1944, Mr. Gaylord resumed his association with the Hoffman Specialty Co. in the capacity of vice president.

DONALD M. FORFAR, Minneapolis, Minn., mechanical engineer, Grinnell Co. Inc. Mr. Forfar was born on August 17, 1885 in Minneapolis and attended the University of Minnesota, graduating with a degree in mechanical engineering in 1909.

Upon graduation, Mr. Forfar became affiliated with Charles L. Pillsbury Co., Minneapolis, where his work consisted of designing and supervising the installation of mechanical equipment layouts for buildings of all types. From January 1918 until August 1919, Mr. Forfar served as a First Lieutenant of Engineers in the United States Army.

After spending a short period of time with A. W. Kerr & Co., Architects and Engineers, Virginia, Minn., he joined the staff of Croft and Boerner, Inc., in Minneapolis, as a

mechanical engineer from 1923-28. He began his association with Grinnell Co., Inc. in 1929 as a sales engineer, the following year becoming a mechanical engineer.

Mr. Forfar served as secretary-treasurer, vice president, and president of the Minnesota Chapter of ASHVE in 1928, 1929 and 1930, respectively. He also served on that chapter's board of governors in 1926 and 1927 and again in 1931.

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ARTHUR E. KRIEBEL, Philadelphia, Pa., sales engineer, Blankin Equipment Corp. Mr. Kriebel was born at West Point, Pa., in 1884 and attended school in Pennsylvania.

Mr. Kriebel's training and early professional experience was obtained with Kriebel & Co. for seven years; Jenkins Bros. for four years; and a period of approximately nine years with the Vapor Vacuum Heating Co. as sales engineer and designer of vapor and vacuum heating systems. He spent ten years with Haynes Selling Co., Inc., from 1935-45, and served as sales engineer with Haynes-Blankin Corp. in 1946 and 1947 remaining as sales engineer with the Blankin Equipment Corp., organized in 1948.

Mr. Kriebel served as a member of the board of governors of the Philadelphia Chapter in 1937.

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STANLEY E. PLEWES, Philadelphia, Pa., sales engineer, Johnson Service Co. Mr. Plewes was born on June 10, 1885 and attended Rochester Athenaeum and Mechanics Institute.

Mr. Plewes received his drafting and professional experience as draftsman and engineer with Alfred R. Wolff and Nygren, Tenney and Ohmes, New York, N.Y. from 1901 to 1911. He first joined Johnson Service Co. in 1913 as a solicitor with the Philadelphia office. In 1917 he was made manager of the Philadelphia office, where he was engaged in contracting for installations of automatic temperature regulating systems. Since 1913, Mr. Plewes has been associated with Johnson Service Co., totaling a period of 37 years of service.

Mr. Plewes served as chairman of the Transportation Committee for the 27th Annual Meeting in Philadelphia in 1921 and is now serving as a member of the Publicity Committee of the Committee on Arrangements for the forthcoming Annual Meeting, also in Philadelphia. He served as a member of the Philadelphia Chapter's board of governors in 1935 and 1936.

## ROSEBROUGHS HONORED BY ST. LOUIS CHAPTER

R. M. Rosebrough and son, J. S. Rosebrough

It was *Rosebrough Night* at a recent ASHVE meeting in St. Louis. R. M. Rosebrough, central district sales manager for the L. J. Mueller Furnace Co. and past president of the St. Louis Chapter, installed his son, J. S. Rosebrough, as new president of the Chapter. A short time later in the meeting, Stoddard Rosebrough, central district representative for the company, had the honor of presenting his dad with an ASHVE Life Membership Certificate.

Born in St. Louis, Bob Rosebrough has been in the heating industry since 1905. In 1913 he joined the L. J. Mueller Furnace Co. as manager of the St. Louis branch, and is now celebrating his 38th year of consecutive association with the company. His son joined Mueller in 1930 and has just become a 20-year man.

### 19TH POWER SHOW

Advanced standards of design applied in modern power plants will be featured by the more than 300 exhibitors at the 19th National Exposition of Power and Mechanical Engineering to be held at Grand Central Palace, New York, November 27 to December 2. The Exposition, under the auspices of *ASME* and held coincident with its annual meeting, will open Monday, November 27 at 2:00 p.m. and will continue daily from 11:00 a.m. to 10:00 p.m., except Wednesday and Saturday when the closing will be at 6:00 p.m.

# Summary of Chapter Meetings

## TWO YOUNG WOMEN MEMBERS HAVE SERVED AS STUDENT BRANCH MEMBERS

"My work in the Society has been and I am sure will continue to be, enjoyable to me as well as worthwhile professionally." The speaker is Helen Lankow Wooley, of Portland, Ore., one of the few women members of the Society. Mrs. Wooley, who was graduated from Oregon State College this year as a

Mrs. William G. Wooley

bachelor of science in mechanical engineering, is an assistant engineer with the firm of Thomas E. Taylor, consulting engineer of Portland.

She lists as her other activities, "the taming and training of a husband, acquired July 8, 1950." Mr. and Mrs. William G. Wooley live at 645 S.E. 41st Ave. Mrs. Wooley joined ASHVE as a student member in 1948 while at Oregon State College, before the formation of a student branch there, and became the first student member of the Oregon Chapter of the Society. As secretary of the Oregon State College Student Branch, she was one of the two girls serving in that capacity at ASHVE student branches.

Mrs. Wooley was born in Portland and is a graduate of Washington High School. While at Oregon State, the attractive daughter of Mr. and Mrs. Paul E. Lankow was president of the Alpha Phi fraternity and assistant manager of *Tech Record*, the engineering school publication.

While an undergraduate, Mrs. Wooley was at various times a draftsman and assistant engineer with the Portland branch of DeWitt C. Griffin and Associates, and North Coast Engineers, Inc.

During the summer of 1948 she was a designer with J. Donald Kroeker, Portland consulting engineer, and an assistant engineer with her present firm the following summer.

Now serving as secretary of the Purdue Student Branch, is pretty, redhaired, June Cox, who lives at 403 Maple St., West Lafayette, Ind. Miss Cox was born at South Bend, Ind., the eldest of three daughters of Mr. and Mrs. William P. Cox. She is a graduate of South Bend Central High School and attends the mechanical engineering school at Purdue University, where heating, ventilating and refrigerating are her specialties.

Miss Cox has worked as a draftsman and she was for a while assistant to the industrial engineer for the *ILGWU* where she did time and

Miss June Cox

motion analyses. Currently she has a part-time position as a draftsman for a construction company.

"Upon graduation next year, I hope to enter the Army Officers Candidate School, eventually to become an instructor," said Miss Cox.

Miss Cox is interested in more than engineering, however, and admits that she is no textbook engineer. Writing, journalistic and creative, is a major interest, she says, adding that men most definitely are also in the picture.

• *ATLANTA*—September 11, 1950. Members and guests met at Harris Tea Room for a social hour, dinner and a business meeting, which was the first of the season. The minutes of the April 1 meeting, which was the last Chapter meeting prior to the summer recess, were read and approved. L. L. Barnes discussed the request for assistance by the city in codifying the installation of air conditioning systems. Mr. Barnes' discussion was only preliminary and it was stated that more would be heard on this subject.

G. D. Guler reported on his attendance at the Chapters' Conference Committee during the Society's Semi-Annual Meeting in Muskoka, praising both the technical and social phases of the program. F. A. Player, program chairman, introduced Marion Darby, Carrier Corp., as the speaker of the evening. Mr. Darby presented, with the use of slides, the story of the development of air conditioning equipment and systems. The subject of his talk was *Air Conditioning for the Four Seasons*. After a short discussion period the meeting adjourned at 9:30 p.m. Attendance 48.

• *CINCINNATI*—September 21, 1950. Pres. E. W. McNamee called the meeting to order in the Terrace Park Country Club, Terrace Park, Ohio. This meeting had been scheduled as a social affair with golf and baseball preceding the dinner. However, due to inclement weather all outdoor activities were restricted.

R. J. Hanschen, chairman of the membership committee, reported for his committee and asked for the cooperation of the members in obtaining new members for the chapter. J. J. Bechtol, secretary-treasurer, spoke briefly on the procedure for the collection of annual dues. President McNamee announced the formation of the *Annual Award* given by the *Technical and Scientific Societies Council of Cincinnati*. After a live-

ly discussion on the subject. B. T. Hauer and F. B. DeBra were appointed to the award committee.

President McNamee called attention to the inspection tour through the residence of Dr. Clarence A. Mills, Cincinnati, which was to be conducted on the following day from 10:00 to 12:00 a.m. The tour was to be followed by a luncheon at the Engineers Club at which time Dr. Mills was to discuss the theory of *Reflective Radiant Conditioning*, the system which is used throughout his residence. Attendance 50.

• *DELTA*—September 12, 1950. The first dinner meeting of the Delta Chapter for the season was held in the Trophy Room of the New Orleans Athletic Club and was called to order by Pres. Ralph Elizardi. Members and guests introduced themselves. The minutes of the previous meeting, which was held on May 9, were read and approved. President Elizardi discussed the proposed formation of an Engineers' Club in New Orleans and Walter Cooke gave a brief discussion on the advantages of forming an Engineers' Club and pointed out that the consensus of other societies was in favor of forming such a club.

The meeting was turned over to R. K. Goode, program chairman, who introduced the speaker of the evening, Raymond Mancha, vice president, ventilation equipment, Joy Mfg. Co., Pittsburgh, Pa. Mr. Mancha's subject was entitled *The Axivane Fan*, and after presenting a discussion on the advantages of the axivane fan, he showed a colored movie on the manufacture of the fan. The meeting adjourned at 9:20 p.m. Attendance 55. Attendance ratio 0.45*.

• *GOLDEN GATE*—September 7, 1950. Pres. K. F. Baldwin called the meeting to order at 7:55 p.m. in the Engineers' Club, San Francisco. After the roll call of members and the introduction of guests, the minutes of the last meeting of the previous season, held on May 4, were read and approved. Reports were given by the membership, legislative, and constitution and by-laws committees, and the publicity committee was commended for the good work it had accomplished in getting publicity notices of the meeting published in several papers. R. C. Cushing, chairman of the program committee, reported that his committee had arranged for interesting programs for the balance of the year and that the December meeting had been scheduled as a dinner dance on December 14 at the Hotel Claremont.

The meeting was concluded with an interesting talk by Professor Reukema, of the University of California, on atomic energy. His subject was *Atomic Power to Supply Man's Need for Eight Billion Years*. The meeting was adjourned at 9:50 p.m. Attendance 62.

• *INLAND EMPIRE*—September 9, 1950. The meeting was called to order by W. C. Vradenburg, the presiding officer and president of the chapter, which was followed by the reading of the minutes of the preceding meeting.

L. E. Marque, program chairman, reported on the October and November meetings and briefly outlined the tentative programs for the season. Reports were given by George Deiter for the attendance committee and Orin Bower for the membership committee.

Mr. Marque then presented the speaker, Mr. Webber, who gave a very interesting talk on *Radiant Heat*. The meeting adjourned at 10:30 p.m. Attendance 43.

• *INLAND EMPIRE*—June 16, 1950. The meeting was called to order by Pres. W. C. Vradenburg and the secretary read the minutes of the previous meeting.

H. S. Jennings, the treasurer, reported on finances and announced that he would make an itemized report at the September meeting. L. E. Marque, the program chairman, reported on the program for the September meeting and then introduced Prof. S. Konzo, research professor in mechanical engineering, University of Illinois, who gave an interesting talk on the subject *Distribution of Air Through Duct Systems*. The meeting adjourned at 11:00 p.m.

• *KANSAS CITY*—September 12, 1950. The meeting was called to order by Pres. W. E. Howarth, the presiding officer, in the Roof Garden of the Aladdin Hotel at 7:30 p.m. After the reading and approval of the minutes of the May 1 meeting, reports were given by the chairmen of the auditing, program, attendance, membership, and entertainment committees. F. K. Ladewig spoke on the first issue of the Kansas City Chapter Newsletter and reported that his committee was well organized.

The program chairman, C. W. Schumacher, introduced the guest speaker, L. P. Cookingham, city manager of Kansas City, who explained the purpose of a civil defense plan and the steps Kansas City is now taking to make this effective as soon as possible. The meeting adjourned at 8:45 p.m. Attendance 70. Attendance ratio 0.35.

• *MANITOBA*—September 18, 1950. The first meeting of the season was called to order at 8:00 p.m. by Pres. C. M. Fleming in Salon D of the Fort Garry Hotel, Winnipeg, Manitoba. The minutes of the April 20th meeting and the treasurer's report were read by W. J. Atkinson, the secretary, both being approved and adopted by the Chapter.

Ernest Lambert introduced the speaker of the evening, Ernest Szekely, Milwaukee, Wis., who is Second Vice President of the Society. Mr. Szekely's subject was *Fans and Their Application*. J. F. Bertram thanked Mr. Szekely on behalf of the Chapter for his interesting talk. The meeting adjourned at 10:15 p.m. Attendance 21.

*Note: The attendance ratios shown represent the membership attendance divided by the chapter membership. These ratios will be useful as a partial indication of interest shown by local chapter members in various types of subjects programmed by the various chapters and may be useful in deciding on subjects for chapter meetings.

• *NORTH CAROLINA*—September 15, 1950. Following a social hour and dinner starting at 6:00 p.m., Pres. M. F. DuChateau called the business meeting to order at the Selwyn Hotel, Charlotte. The reading of the minutes of the last business meeting, which was held in May, was dispensed with and a brief report was given on the chapter's summer meeting held in June at Roaring Gap. After a discussion on the possibility of holding a future Society Semi-Annual Meeting in North Carolina, Prof. C. A. McKeeman was requested by President DuChateau to extend an invitation to the Society, on behalf of the chapter, to hold a Semi-Annual Meeting in North Carolina. J. E. Hart, program chairman, announced that the final two meetings of the year were tentatively scheduled for October 27 in Durham, and December 8 in Greensboro.

Mr. Hart then introduced the speaker of the evening, H. A. Lockhart, chief engineer, Bell & Gossett Co., Morton Grove, Ill., who discussed *Hot Water Heating and Its Problems*, particularly emphasizing problems pertaining to the pumping of fluids. Mr. Lockhart's talk was very well received and was followed by a lengthy discussion period, in which the majority of the members present participated. The meeting was adjourned at 10:15 p.m. Attendance 72. Attendance ratio 0.39.

• *NORTH CAROLINA*—June 23-25, 1950. The North Carolina Chapter held its annual summer meeting at the Graystone Inn, Roaring Gap, June 23-25, 1950. The meeting was a social affair for the benefit of members, their wives and their guests. The three days were devoted to a weekend of recreational and sports activities, including a golf tournament for the men and bridge and canasta for the ladies. A formal banquet was held on Saturday evening with W. H. Sullivan acting as master of ceremonies. Following introduction of the Chapter officers and several outstanding guests, prizes were awarded to the winners of the golf and bridge tournaments. Dinner was followed by dancing until 12:30 p.m., at which time the local musical talent presented an impromptu *jam session*. The weekend activities were brought to a close on Sunday at noon with an informal buffet luncheon.

• *NORTH TEXAS*—August 21, 1950. Herman Blum, president of the Chapter, opened the meeting in the Melrose Hotel at 7:50 p.m. and the members and guests introduced themselves. The minutes of the July meeting were read and approved. After considerable discussion on changing the date of election and inauguration of officers, it was moved that officers be elected in January and inaugurated in February.

C. Rollins Gardner announced that Reg F. Taylor, consulting engineer, Houston, had been nominated as Second Vice President of the Society. This was followed by a program on the subject of controls, in which the following took part: H. V. Alexander, Johnson Service Co., Dallas; F. C. Brandt, Minneapolis-Honeywell Regulator Co., Houston; R. G. Lyford, The Powers Regulator Co., Dallas; and J. D. Poythress, W. E. Lewis & Co., Dallas. The program was followed by a question and answer period. The meeting adjourned at 9:20 p.m. Attendance 84. Attendance ratio 0.40.

• *OREGON*—September 7, 1950. Chapter members and guests met at the Old Heathman Hotel and after the meeting had been called to order by R. C. Chewning, president, the secretary read the minutes of the May 4 meeting, which were approved as read. President Chewning called a 15 minute recess, at the end of which B. W. Farnes, general chairman of the Committe on Arrangements for the 1951 Semi-Annual Meeting, presented a preview showing of the color film *This is Oregon*. The film will be circulated extensively throughout the chapters of the Society to promote attendance at the 1951 Meeting. The film was followed by a discussion of plans for the coming Portland Meeting.

The meeting was then turned over to President Chewning, who read reports from the treasurer, the research committee, and the board of governors regarding their activities during the summer months, the major points being the recommendation of the selection of Walter Hanthorn to serve on the Portland Board of Heating Engineers and the submission of suggestions to the Building Department of the City of Portland to aid in the formulation of a garage ventilation code. H. W. McKenzie, chairman of the meetings committee, reported that three or possibly four speakers obtained from the list furnished by the Society would address the chapter in the coming year and commented upon the abundance and excellence of the selection available to the chapter. The meeting was adjourned at 10:10 p.m. Attendance 58.

• *SOUTH TEXAS*—September 15, 1950. Pres. H. W. Broadwell called the meeting to order and the minutes of the preceding meeting were read and approved. Reports were given by E. G. Floeter, Jr., treasurer, and by J. C. Lewis, chairman of the membership committee. C. C. Quin, president of the chapter, presented the chapter with a rostrum engraved with the ASHVE emblem. The Chapter then presented R. J. Salinger, the retiring president, with the chapter past president's pin.

The speaker of the evening was Lewis W. Cutrer, an attorney, who spoke on the liabilities and responsibilities of the architect, engineer and contractor in the design and installation of air conditioning systems for buildings. Mr. Cutrer gave specific examples of cases tried in court and the law's interpretation of various cases. A question and answer period followed. The meeting was adjourned at 10:15 p.m. Attendance 60. Attendance ratio 0.26.

• *SOUTH TEXAS*—August 25, 1950. Members and guests met at

Bill Williams Restaurant and Pres. H. W. Broadwell called the meeting to order at 8:00 p.m. President Broadwell asked for self-introductions and the reading of the minutes of the previous meeting was held over until the next meeting due to the absence of the secretary.

The meeting was turned over to J. Wayne Holland, the program chairman, who introduced the speaker of the evening, Morris Frank, journalist. Mr. Frank delighted his audience with a two hour extemporaneous talk in which he poked gentle fun at the engineering profession, contractors, journalists, etc. It was a consensus among the members that Mr. Frank would be welcome to speak before the Chapter again at any time. The meeting adjourned at 10:30 p.m. Attendance 63.

• *SOUTHWEST TEXAS*—September 19, 1950. The meeting was called to order by Pres. L. S. Pawkett, in the Tapestry Room of St. Anthony Hotel, San Antonio. The minutes of the August meeting were read and approved and after the completion of chapter business, I. W. Wilke introduced the first of the four speakers scheduled for the evening. A. T. Moses, partner, Darley & Moses, Austin, gave an interesting discussion on the design and installation of an air conditioning system for a bank building. He stressed the fact that there is no *royal road to design* from the standpoint of one design method that can be applied to all situations. Mr. Moses' discussion of the design conditions, the method of zoning, the control system and the operation of the entire system was interesting and informative.

Since the second speaker, D. F. Schuett, president, Climate Inc., could not be present, President Pawkett gave a brief summary of the paper and suggested that it be held over for another meeting.

This was followed by the introduction of J. G. Hopping, Jr., sales engineer, F. J. Evans Engineering Co., San Antonio, who gave an excellent discussion on the application and *misapplication* of unit heaters. The speaker brought out several very interesting points on special applications and warned of some of the troubles to be expected in *experimental* use of such heaters, especially as duct heaters for all year systems where the heaters would not be in use during the cooling season.

The last speaker of the evening, W. L. Maurer, construction superintendent, Johns-Manville Sales Corp., San Antonio, presented interesting facts relative to the use of insulation in air conditioning systems. Economic factors influencing the use of insulation, the choice of types of insulation, and the correct installation, application, and maintenance of insulation were discussed. All talks created much interest and numerous questions were submitted and discussed from the floor. The meeting adjourned at 10:15 p. m. Attendance 46. Attendance ratio 0.67.

• *SOUTHWEST TEXAS*—August 25, 1950. I. W. Wilke, vice president, was the presiding officer and called the meeting to order at 9:00 p.m. in the Terrace Room Annex of the Driscoll Hotel, Corpus Christi. Mr. Wilke announced that Society President Lester T. Avery was the scheduled speaker for the November meeting of the Chapter in San Antonio. The nominating committee was elected as follows: A. J. Rummel, *chairman;* S. N. Byrne, L. H. Hornor, Jr., C. A. Mansheim, and R. F. McCary.

O. W. Jones, director of industrial development for the Central Power and Light Co. and speaker of the evening, spoke on the subject *Gulf Coast Industries*. Mr. Jones quoted some statistics of the larger manufacturing plants located near Corpus Christi, and also gave a list of the many articles being produced by these companies and displayed samples of some of them. A brief discussion period followed. Attendance 18.

• *WISCONSIN*—September 18, 1950. After calling the meeting to order in the Engineers Society Building, Pres. F. J. Nunlist welcomed the members and guests at the first meeting of the 1950-51 season and urged all members to become more active in the Chapter's activities. President Nunlist then requested brief reports from the following committee chairmen: employment—A. S. Krenz; membership—L. C. Plaehn; public relations—J. R. Vernon. In the absence of J. A. Lofte, President Nunlist presented the treasurer's report and H. F. Brinen, reporting for the program committee, stated that the October meeting would be a combined meeting with the Engineers Society of Milwaukee and the speaker would be Prof. A. G. H. Dietz of Massachusetts Institute of Technology.

The speaker of the evening was Gerald Blanton, metallurgist, Wolverine Tube Div., Calumet and Hecla Consolidated Copper Co., who spoke on *Copper—From Ore to Finished Product*. Mr. Blanton discussed the manufacturing processes with specific reference to quality controls. He referred to government and individual specifications which affect the fabrication and manufacturing processes of the finished product. He showed a colored film which described in great detail the various processes in which the manufacture of copper passes from the mine to the finished product. The modern methods used in these various processes, such as blasting, loading and conveying were clearly shown. The various stages of the reduction of copper were shown together with the care taken in the removal of impurities. The fabrication of ingots into finished shapes, such as tubes, rods, sheets, etc., was also shown. The film also showed great care in maintaining quality control of all items with specific reference to capillary tubing used in refrigeration equipment, and such quality controls procedures include pressure tests, hardness tests, flow testing, consistency and accuracy of dimensions. Following an open discussion, the meeting was adjourned by President Nunlist at 9:40 p.m. with a rising vote of thanks to the speaker. Attendance 53. Attendance ratio 0.22.

# Candidates for Membership

The Society's By-Laws require that all applications for membership or advancement are to be sent to the Executive Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society, or mailed to all members. When the replies are received from references the Candidate's application shall be submitted to and acted upon by the Admission and Advancement Committee as soon as possible.

When the Admission and Advancement Committee has acted favorably upon a Candidate's application and assigned his grade, the Council shall confirm the election of the proposed Candidate for membership. During the past month 60 applications for membership, including 3 student applications, 1 reinstatement; and 7 advancements have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Admission and Advancement Committee, and in turn, the Council, urge members to assume their share of responsibility of receiving these candidates into membership by advising the Executive Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by November 30, 1950, these candidates will be voted upon by the Council. Those elected to membership will be notified by the Executive Secretary immediately after election.

BAKER, C. M., Chief Engr., Ingersoll Steel Div., Borg-Warner Corp., Kalamazoo, Mich. REFERENCES: R. S. Ingersoll, H. R. Limbacher, C. R. McConner, H. W. Walters.

BEST, H. L., Vice-Pres., W. H. Cunningham & Hill, Ltd., Toronto, Ont., Canada. REFERENCES: J. H. Fox, G. H. Hopper, N. W. Kingsland, William Philip.

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## REINSTATEMENT

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NORDMAN, C. M., Designer, The Gas Service Co., Wichita, Kan. REFERENCES: R. F. Bauer, E. G. Fahnestock, W. T. Miller, H. D. Speyer.

PRESSLER, J. D., Designer, A. M. Strauss, Inc., Ft. Wayne, Ind. REFERENCES: R. T. Buckmaster*, V. M. Dochez*, E. H. Hattersley, P. E. Quick*.

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## *ASRE* TO MEET IN NEW YORK, DECEMBER 3-6

The New York Section of *ASRE* will be host for the 46th Annual Meeting of the *American Society of Refrigerating Engineers*, which will be held in New York City, December 3-6, 1950. All events of the meeting, except for inspection trips and sightseeing expeditions, will be held at the Hotel Commodore.

An interesting program, both technical and general, has been arranged and includes such well known figures as Dr. Clarence A. Mills, professor of experimental medicine at the University of Cincinnati, and Vilhjalmur Stefansson, world famous arctic explorer and author.

The title of Dr. Mills' talk will be *Reflection Point*, which will describe his new home in Cincinnati, in the construction of which is incorporated many of his revolutionary ideas and applications of radiant heating, air conditioning, and the principles of reflectivity. Mr. Stefansson will speak at the welcome luncheon on

Non-member

Monday on *Natural Cold Storage*—how the permanently frozen ground of arctic regions can be utilized to advantage, and some of the problems which arise.

Arthur J. Hess, Los Angeles, a director of *ASRE*, is in charge of the technical program for the meeting and will be assisted by: M. M. Bolstad, H. E. Degler, A. L. Hesselschwerdt, Jr., Fritz Honerkamp, G. K. Iwashita, R. C. Jordan, J. E. Leininger, R. H. Lock, J. P. McShane, H. H. Peterson, H. F. Spoehrer, D. L. Williams, and W. S. Woodside.

One of the concluding events of the meeting will be the installation of *ASRE* officers for 1951.

### NYU TO HEAR R. W. WATERFILL

A. C. Buensod, president of Buensod-Stacey, Inc., New York, N. Y. and Charlotte, N. C., has announced that R. W. Waterfill, vice president of Buensod-Stacey, Inc. will deliver lectures on refrigeration equipment and systems at the Second Annual Seminar on New Developments in Heating and Air Conditioning under the auspices of the College of Engineering of New York University.

## OBITUARIES

### DANIEL J. FAGIN
**St. Louis, Mo.**

Daniel J. Fagin, a member of the Society since 1933 and an active member of the St. Louis Chapter, died on August 24, 1950 at St. John's Hospital, in St. Louis. Mr. Fagin, who was affectionately known as "Dan," was born on January 19, 1900 in St. Louis and attended Alexander Hamilton Institute and specialized in heating, ventilating and refrigeration.

From 1921-23, Mr. Fagin served as purchasing agent for The Brecht Co. He helped organize the Eskimo Refrigeration Co. and served as sales manager for the company from 1923-25. Mr. Fagin joined the American Radiator Co. in 1925 as a sales representative, contacting architects, builders, home owners and heating contractors. He joined Laclede Gas Light Co. in 1933 as a heating engineer and was made assistant sales manager in 1941, which position he held till the time of his death.

Mr. Fagin was president of the St. Louis Chapter in 1941-42 and for the

Daniel J. Fagin

past three years had been a member of the executive board of the Chamber of Commerce Sales Managers' Bureau. He was very active in the Downtown Kiwanis Club of St. Louis. He is survived by his wife, who resides at 3364 Lawn Avenue, St. Louis, a daughter, his mother and a brother, to whom the Officers and Council of the Society extend their sincere sympathy.

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### ROBERT H. FELTWELL
**Washington, D.C.**

Word has just been received of the death of Robert H. Feltwell during the past month. Mr. Feltwell, a member of the Society since 1905, was made a Life Member in 1937. He was born on December 1, 1871 in Brooklyn, N.Y. and attended school there.

Mr. Feltwell served his apprenticeship with Watson and Poole, Philadelphia from 1889-91. He spent five years as a heating contractor and then joined Herendeen Mfg. Co., Geneva, N.Y., and was also associated with Jas. Spear Stove and Heating Co., Philadelphia, as steam and hot water heating engineer. Mr. Feltwell was associated with the D & T Mfg. Co., St. Louis, Mo., first in the capacity of a heating engineer and then in 1926 he was made district manager. He served as special sales representative for Pierce, Butler & Pierce Mfg. Corp., in Baltimore, in 1931-32 and in 1934 he joined the U.S. Radiator Corp. as a heating engineer. In 1944 he joined the National Bureau of Standards as a heating engineer and was associated with the Bureau of Standards at the time of his death.

Mr. Feltwell was active in the Philadelphia and Washington, D.C. Chapters, having served on many of the Chapter committees.

He is survived by a wife, to whom the Officers and Council of the Society extend their sincere sympathy.

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### FRANK N. TUCKER
**New York, N. Y.**

The Society has been notified of the death of Frank N. Tucker on August 18, 1950 after a long illness. Mr. Tucker was born on June 4, 1883 at Ottawa, Ill. After completing high school, Mr. Tucker took an electrical and a heating and ventilating course of the International Correspondence Schools and attended two years of nautical school and one year of law school.

Mr. Tucker spent his entire professional career with Ilg Electric Ventilating Co., New York, N. Y., beginning in 1915 as the foreman of the testing department. Three years later he was made foreman in charge of the entire electrical division and in 1922-24 he was appointed as a research engineer. The next year he was appointed field engineer and was engaged in the designing and testing of fans, blowers and installations and inspecting and revising old installations. At the time of his retirement, on April 1, 1949, Mr. Tucker was chief field engineer with Ilg Electric Ventilating Co.

He was also a member of the *American Institute of Electrical Engineers*.

Mr. Tucker is survived by his widow, to whom the Officers and Council of the Society extend their sincere sympathy.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Headquarters: 51 Madison Ave., New York 10, N. Y. (Tel. Murray Hill 3 0291)

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● **CONNECTICUT:** Organized 1940. Headquarters, New Haven, Conn. Meets, Third Thursday. PRESIDENT, D. M. Hummel, 20 Ashmun St., New Haven. SECRETARY, G. F. Nieske, 794 Bee St., Meriden.

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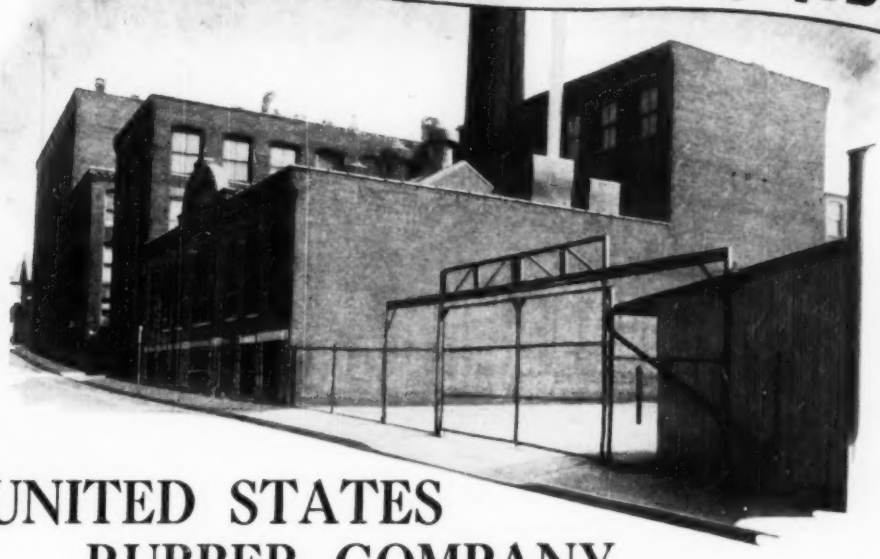

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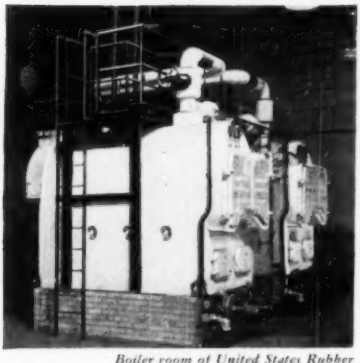

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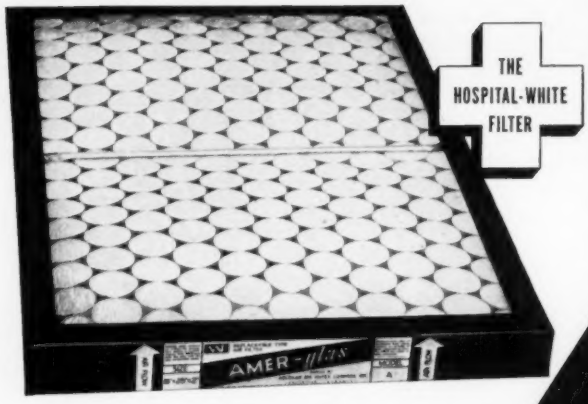


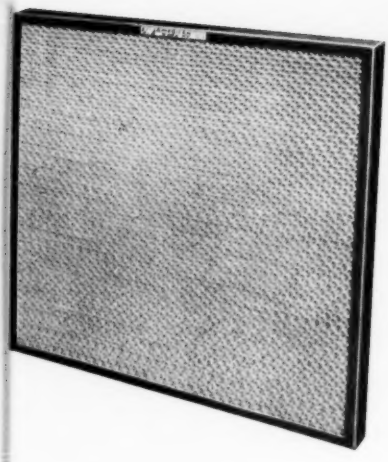

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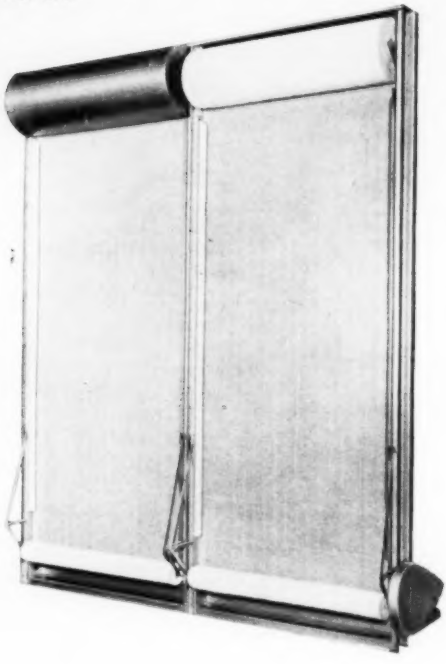

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General View of 9th International Heating & Ventilating Exposition at Chicago in 1949.

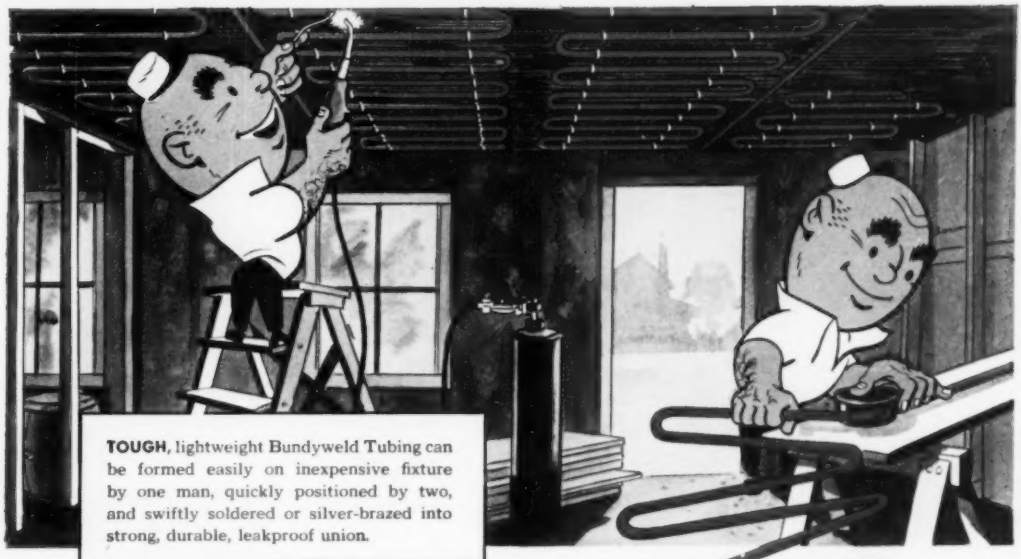
# You Can Profit from this Panorama of Progress

Whatever your interest in HEATING, VENTILATING and AIR CONDITIONING, it will pay you to come to Philadelphia's huge Commercial Museum next January 22-26. Here you will see over 300 exhibits of the latest products and advanced practices for conditioning air in all types of buildings, industrial plants, institutions, and homes . . . the largest event of its kind ever held. An unequalled opportunity for you . . . to see and compare hundreds of new and improved cost-saving items ranging from complete units to maintenance supplies . . . to get time-saving solutions to problems . . . to discuss future plans and requirements first-hand with engineering specialists. You'll come away with more sound, practical ideas than you could ever get in any comparable time or way. So plan NOW to attend . . . and profit from this most instructive, valuable exposition — January 22-26, 1951.

Auspices of
The American Society of Heating & Ventilating Engineers

TENTH
*Air Conditioning*
Exposition
INTERNATIONAL HEATING & VENTILATING EXPOSITION
COMMERCIAL MUSEUM, PHILADELPHIA, PA.
JANUARY 22-26 1951

Management International
Exposition Co.



**TOUGH,** lightweight Bundyweld Tubing can be formed easily on inexpensive fixture by one man, quickly positioned by two, and swiftly soldered or silver-brazed into strong, durable, leakproof union.

# Better radiant heating with Bundyweld ...because it's better tubing!

**No other** tubing offers more practical, on-the-site fabrication advantages or more desirable properties to your radiant heating systems than Bundyweld.

*No other tubing is double-walled from a single strip!* It's sturdy and strong—takes knocks and jolts of handling without denting or collapsing structurally. Yet Bundyweld's ductility allows one-man forming with no special fixture, while its lightness means quick two-man positioning of formed grid. In short, when Bundyweld goes on the job, extra savings in time and labor go right with it.

Bundyweld is copper-bonded through 360° of its double-wall contact; *double* the protection against breaks or leaks through years of use. Tinned or copper-coated Bundyweld is available for immediate delivery in sizes up to ⅝" O.D. in quantities to meet any job requirements. For floor installations, tinned Bundyweld is recommended.

Get the complete, amazing story of Bundyweld Tubing in the Bundy radiant heating brochure.

Write: ***Bundy Tubing Company, Detroit 14, Michigan.***

# Bundyweld® Tubing

**DOUBLE-WALLED FROM A SINGLE STRIP**

**WHY BUNDYWELD IS BETTER TUBING**

**Bundyweld starts as a single strip of basic metal, coated with a bonding metal. Then it's . . .**

**continuously rolled twice around laterally into a tube of uniform thickness, and**

**passed through a furnace. Bonding metal fuses with basic metal, presto—**

**Bundyweld . . . double-walled and brazed through 360° of wall contact.**

**NOTE** the exclusive patented Bundyweld beveled edge, which affords a smoother joint, absence of bead and less chance for any leakage.

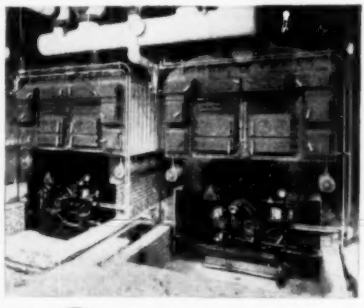
# Hold it!

## you don't need a Tall Chimney with an H. B. SMITH BOILER

To keep the lines of that modern functional school within the proper architectural proportions — and to give your client truly outstanding heating plant performance — we suggest an H. B. Smith boiler.

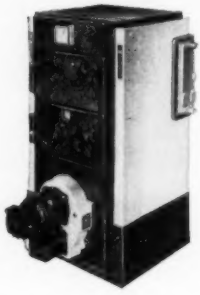
The vertical water tube design of H. B. Smith boilers provides minimum draft resistance. Hot gases rise naturally between the boiler sections before entering the side flues. This positive gas travel is an advantage not found in boilers of the return-flue or long-fire-tube type, in which draft loss through the boiler is much greater. Tall chimneys or complicated induced-draft controls are, therefore, not necessary with H. B. Smith boilers.

For added assurance of economy of operation and long-life performance in schools or other buildings, consider the many, many installations in older schools where H. B. Smith Cast Iron Boilers have been giving top performance for 25, 35, even 50 years! You can recommend an H. B. Smith boiler for the life of the building!



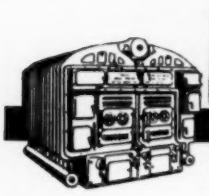
*A modern school equipped with No. 60 Smith Boilers.*

SMITH-MILLS "20" BOILER for Hand Firing. These smaller H. B. Smith Boilers have the same vertical flue travel, hence the same low-draft requirements as do the famous big "MILLS" Boilers.



SMITH-MILLS "1100" BOILER-BURNER UNIT. A complete heating plant for the average home — equipped with oil burner and tankless heater. Extended type jacket available.

You may be interested to know that H. B. Smith manufactures the most complete line of modern cast iron boilers in the world. Let us help you satisfy your customers with convincing data and case histories.



H. B. Smith

CAST IRON BOILERS

**THE H. B. SMITH CO. INC., WESTFIELD, MASS.**

*Most complete line in the world of cast iron boilers for heating*

# DON'T BE SATISFIED WITH HALF-WAY MEASURES...

## insist on Walseal® products and be certain

**– the FACTORY INSERTED Ring insures FULL PENETRATION of the Silver Alloy . . . a perfect joint**

Today, contractors . . . builders . . . architects are using brazed connections, in ever increasing numbers on their brass and copper pipe runs. However, they must be certain that the correct brazing alloy is used; that the joint has penetration of alloy up the shoulder of the fitting.

That's why more and more are turning to Silbraz® joints made with Walseal valves, fittings and flanges which assure the proper amount of alloy with no waste. They know that the finished joint not only will withstand hydrostatic pressure, but it will also withstand terrific impact and vibration – in fact, no correctly made Silbraz joint has ever been known to creep or pull apart under any pressure, shock, vibration or temperature which the pipe itself can withstand.

Furthermore, it is a relatively simple operation to make a Silbraz joint – no heavy scaffolding need be erected . . . just cut the pipe, flux, assemble, then braze, following the technique recommended by the Walworth Company. A silver brazing alloy – FACTORY INSERTED – in each port flows out when heated with the oxyacetylene torch, making a joint that is stronger than the pipe itself . . . a one-hand operation, with the mechanic out of the path of the deflected heat – at all times.

*For full information about Silbraz joints made with Walseal products, write for Circular 84.*

SEE OUR CATALOG IN SWEET'S

# WALWORTH

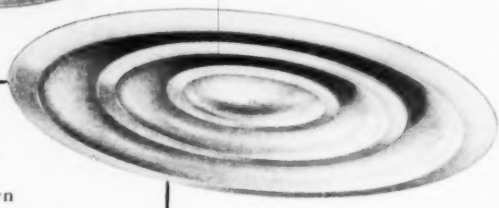
**valves and fittings**

**60 EAST 42nd STREET, NEW YORK 17, N. Y.**

DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

# venturi-flo
# CEILING OUTLETS

**MODEL "J"**



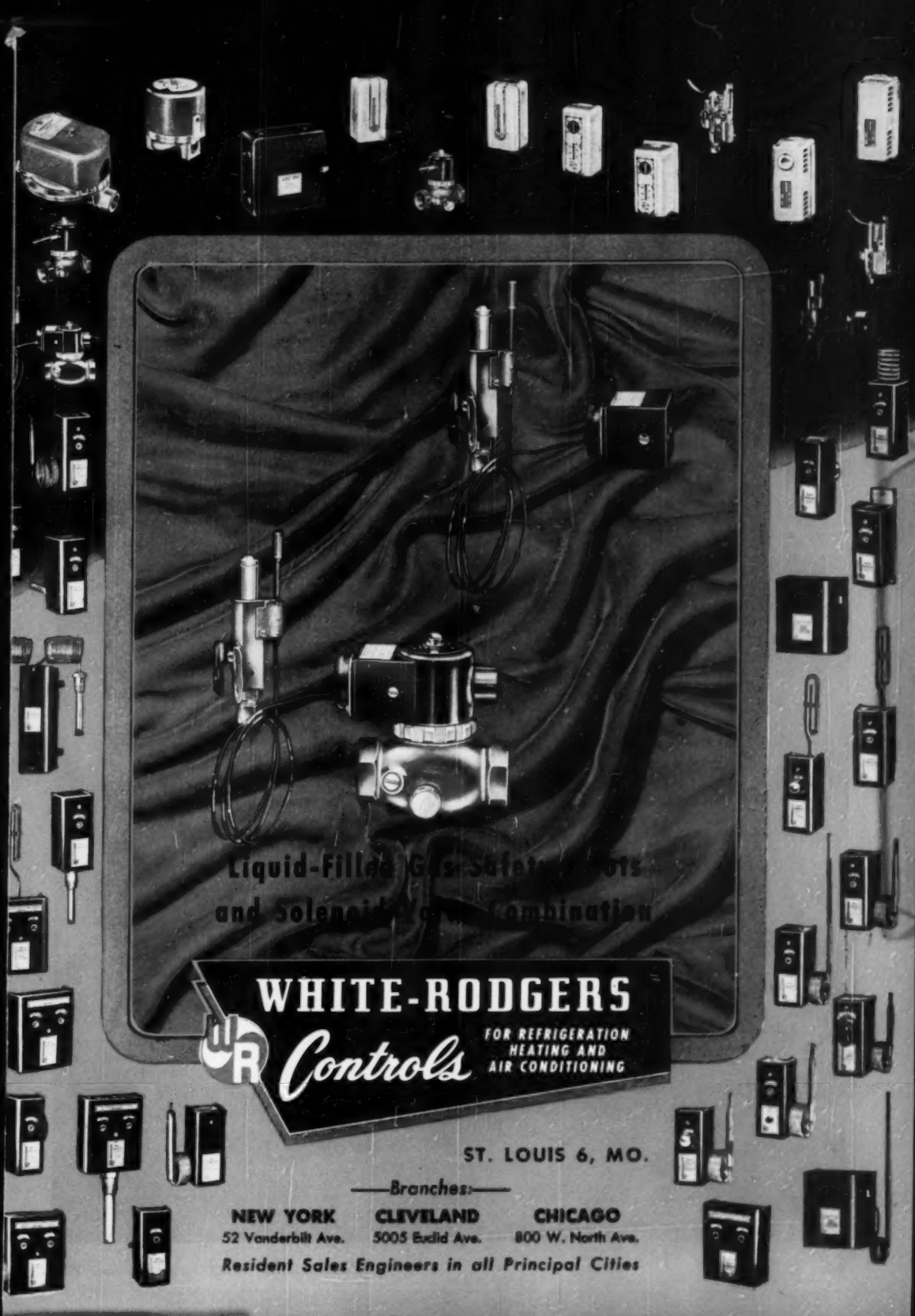
Model "J" VENTURI-FLO Ceiling Outlets are available with a built-in volume control as shown above. Blades are gang-operated and opposed-blade design provides positive air control and uniform distribution of air in throat of outlet. A concealed adjusting lever is accessible after unit is placed in service. Model "J" Ceiling Outlets provide adjustable air pattern over a wide range by means of a key socket which raises or lowers the inner assembly.

*For full information, see your Barber-Colman representative or write for Bulletin F-4085.*

- LOW NOISE LEVEL
- LOW PRESSURE DROP
- ENGINEERED FOR COMFORT CONDITIONING
- FLUSH MOUNTING
- SUPPLY AND EXHAUST
- COMPLETE RANGE OF SIZES

BARBER COLMAN

**BARBER-COLMAN COMPANY, 1228 Rock St., Rockford, Illinois**


Liquid-Filled Gas Safety Shuts
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WHITE-RODGERS
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Resident Sales Engineers in all Principal Cities

# Heating a great

The formal opening of Our Lady of Lourdes Hospital on July 1, 1950, signalized the completion of a $4 million project which is the last word in hospital construction and equipment.

Steam was selected for the heating of this great institution—steam harnessed and brought under control with a Webster Moderator System of Steam Heating. An Outdoor Thermostat adjusts the supply of steam with every change in temperature. Prevents wasteful overheating. Maintains comfort conditions during mild weather or on the severest winter day.

Our Lady of Lourdes Hospital, Camden, N. J. At left: corner of a typical semi-private room.

# New Hospital

Webster System Radiators, taking no useable room space, were engineered into sanitary enclosures integrated with the window construction. Metal front provides easy access if necessary. Each convector has a built-in radiator trap and valve, permitting 100% heat shut-off—no dampers are needed.

Operation of the institution is under the direction of the Sisters of the Third Order Regular of St. Francis. Included in the Hospital is the Bishop's suite and a chapel seating 250.

An important factor in the success of Webster Heating installations is the friendly service and close cooperation of the authorized Webster Factory Representative. Call him or write us for his name. Address Dept. HP-11.

**WARREN WEBSTER & CO., Camden 5, N. J.**
Representatives in Principal Cities
*In Canada, Darling Brothers, Limited, Montreal.*

**WEBSTER**
**MODERATOR**
**SYSTEM**
**OF STEAM HEATING**
**"Controlled by the weather"**

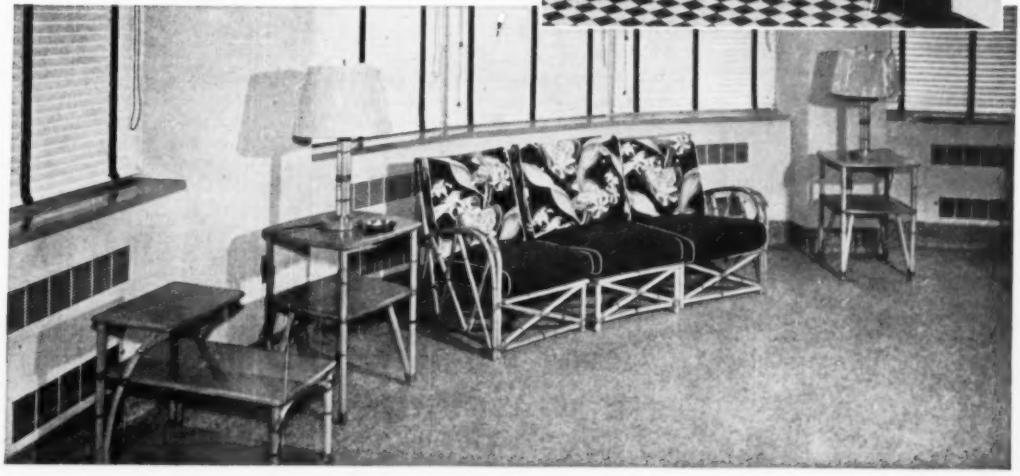
*Architect:*
Paul C. Reilly, New York.

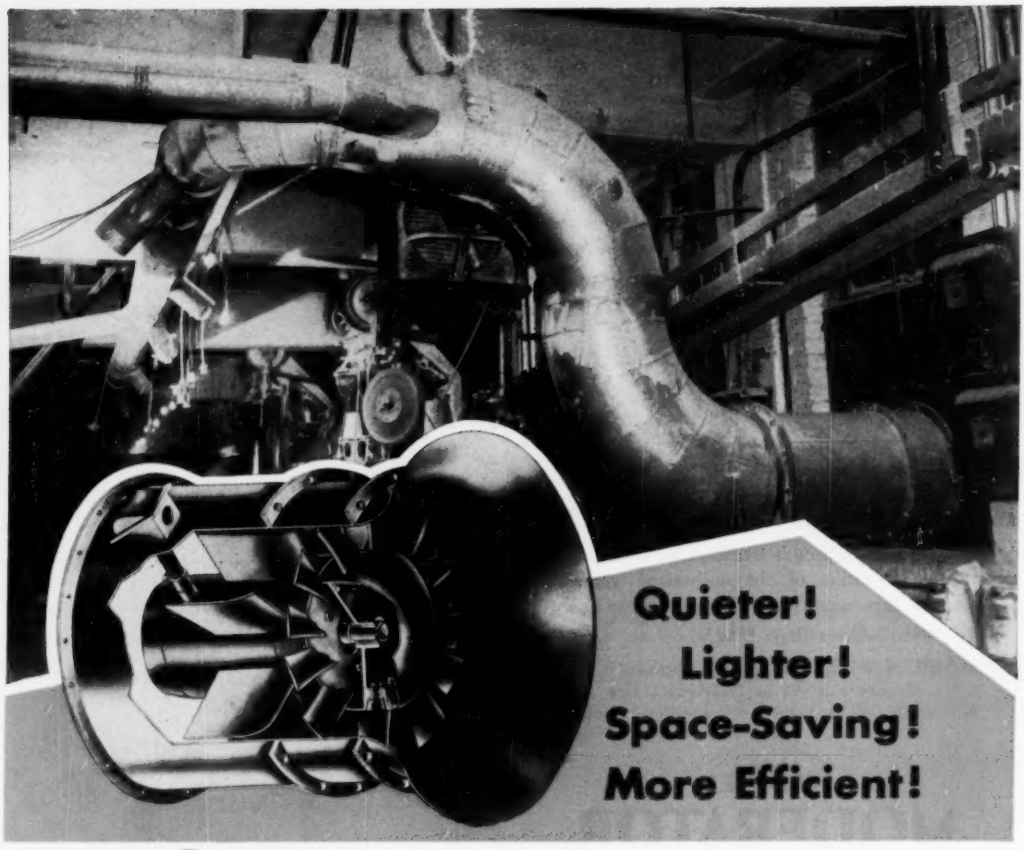
*Builder:*
George A. Fuller Company, New York.

*Consulting Engineer:*
Sears & Kopf, New York.

*Heating Contractor:*
Daniel J. Keating Co., Philadelphia.

Chief Engineer A. D. Bradley uses master key for heat shut-off at individual radiators. Shown at bottom of page is one of 14 solariums.






# JOY AXIVANE* FANS

## (SERIES 1000)

Write for Bulletin, or

*Consult a Joy Engineer*

The quieter operation, lighter, more compact design, lower power consumption and unmatched efficiency of JOY Axivane Fans are *real* advantages! What's more, their vaneaxial design and in-line construction permit mounting right in the air duct, making installation simple and saving greatly on time and cost. These features, plus the extreme flexibility of operating range made possible by adjustable blades—a standard feature of all JOY Fans—mean better, more dependable and lower-cost ventilation, no matter what your conditions are.

● Let JOY Axivane Fan specialists work with you for best results on your ventilation jobs.

*Reg. U. S. Pat. Off.

W&D 12355

**JOY MANUFACTURING COMPANY**

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

# HIGH DISCHARGE PRESSURES *PLUS* ANTI-FRICTION CONSTRUCTION

*Illustrated: A Series 3 pump from the Roth line, one of 62 models each providing a different range of capacities and heads.*

## AVAILABLE IN A SINGLE STAGE IN ROTH TURBINE TYPE PUMPS

Roth Turbine Type pumps fill a need between conventional centrifugal and rotary designs . . . combining the high discharge pressures of rotary pumps with the friction free operation of centrifugals. Capacities range from one to 200 gpm, heads range to 500 feet.

**APPROXIMATE SELECTION** because of their wide operating range, makes Roth Turbine Type pumps most practical for applications where head conditions cannot be accurately determined in advance or are subject to variation.

**RECOMMENDED APPLICATIONS** include the food and chemical industries where the ability to pump from vacuum at 29½ inches with only three feet suction head offers installation economies not possible with other types of equipment. For the heating engineer who must pump water at near boiling point, the self-venting, vapor clearing characteristics plus the high discharge head in a single stage make Roth pumps essential for boilers up to 750 HP. For the petroleum industry, these same advantages become increasingly important with the increased use of LPG. Cooling towers, water treatment equipment, filter presses, centrifugal separators, steam generators and water systems are among other recommended applications.

**SPECIAL METALS** for the chemical and food industries are available for quick delivery. 18-8 and 316 stainless pumps are stocked in many sizes while Hastelloy, special bronzes, illium, or ni-resist pumps can be made to order. The simplicity of design of the liquid end lends itself to construction in special metals quite readily.

**CONSTRUCTION FEATURES** include positive location of the impeller which eliminates metal-to-metal contact, accomplished with a combination of bearing pre-loading spring, sealed ball bearings and a particularly rugged stainless shaft. Packing maintenance is reduced since Roth pumps have only a single box. Easy access to the liquid end is provided by mounting both ball bearings on one side of the impeller. The outboard head and the impeller may be removed without disconnecting piping or disturbing pump and motor location.

**YOUR ROTH DISTRIBUTOR** is prepared to furnish details and recommendations on the Roth Turbine Type pump to suit your installation. Contact him today!

SALES & SERVICE IN THESE PRINCIPAL CITIES:

**ROY E. ROTH CO. ROTH PUMPS** 2484 Fourth Ave. ROCK ISLAND, ILL.

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850 South High Street

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John L. Underwood Co., Inc.
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DETROIT—Vermont 6-4689
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# Zallea Expansion Joint News

PUBLISHED BY ZALLEA BROTHERS—WORLD'S LARGEST MANUFACTURERS OF EXPANSION JOINTS EXCLUSIVELY

**Expansion Joint of the Month**

## OPERATION D-E-E-P FREEZE

### LOW PRESSURE TYPE

The Zallea Low Pressure Corrugated Expansion Joint is used to absorb vibration and protect machinery. Made of stainless steel, these joints are of the non-equalizing type and are limited in

◆ Figure 7

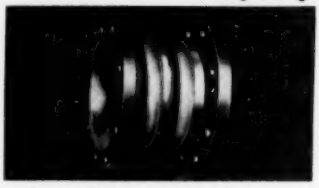


Figure 8 ◆

service to ½" maximum axial movement and 50 lbs. maximum working pressure. Furnished with a single corrugation (Figure 7), or with multiple corrugations (Figure 8), they are primarily used on condensers, turbines, stage bleeders, pumps, and between connected equipment where slight movement and vibration occurs. Industry, with its increasingly high temperature problems, relies on the Zallea Low Pressure Corrugated Expansion Joint for smooth flow and maximum operating performance. For your expansion problem, always specify the *best* in expansion joints . . . specify *Zallea*, you'll find it pays!

The supply is going fast . . . send *TODAY* for your copy of Catalog 47, a text book and valuable reference source on all Zallea Expansion Joints.

ZALLEA BROTHERS, 816 Locust Street, Wilmington 99, Delaware

### Our Readers Ask

**Q.** *A friend and I recently had a friendly argument over copper vs stainless steel expansion joints. What are your views? A. T. M., Conshohocken, Pa.*

**A.** Except where corrosive conditions prevent, stainless steel may be used wherever copper is used. Although slightly more expensive in its initial cost, the use of stainless steel will result in much lower overall cost because of its increased life. Having approximately three times the tensile strength of copper, stainless steel elements can be made with a wall thickness approximately ⅓ that required for copper to withstand the same working pressure. As the life of a corrugated element varies inversely with the thickness of the element, a stainless steel expansion joint will last several times longer than a copper expansion joint designed for the same operating pressure.

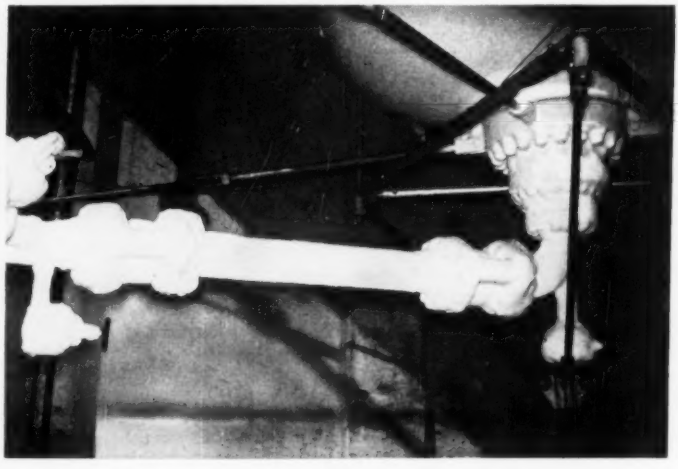
*Your questions are welcomed. Address all letters to Engineering Dept. 917.*

### Temperature and Pressure Problem Solved by Zallea

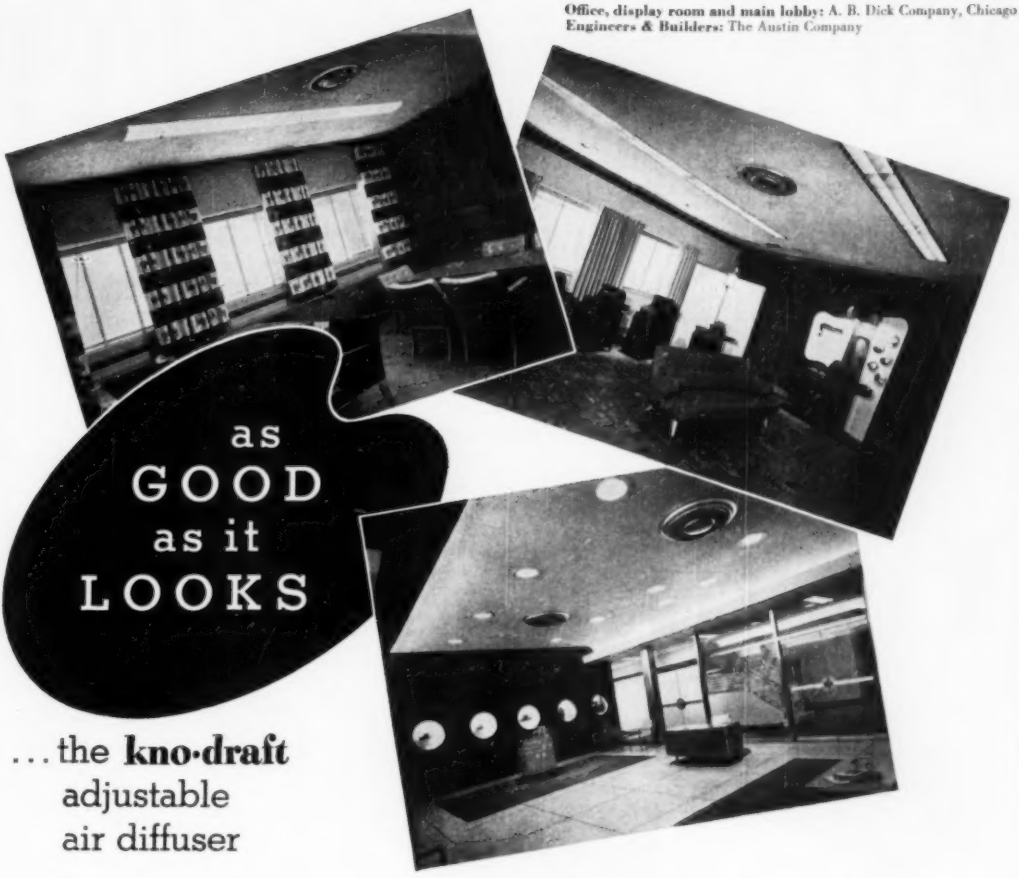
Recently Zallea engineers were faced with a problem of developing expansion joints for operation on a liquid oxygen line, operating at —320° F., under extreme pressure at a large classified government facility. Because of the unusual nature of this installation, Zallea engineers designed *both* the piping layout and the expansion joints. Special stainless steel alloys were selected for the expansion joints to withstand the severe operating conditions.

#### *Zallea Joints Tested*

Shown here in operation, under a heavy layer of frost, are two of a group of 14 six inch Zallea Toroidal Hinged Type Stainless Steel Expansion Joints, with stainless steel construction throughout including the hinges and flanges. Prior to shipment, these Zallea Stainless Steel Expansion Joints were factory-tested to 1400 pounds hydrostatic pressure for a period of 8 hours to insure long life and satisfactory job performance.



**Office, display room and main lobby:** A. B. Dick Company, Chicago
**Engineers & Builders:** The Austin Company



as GOOD as it LOOKS

## ...the **kno·draft** adjustable air diffuser

Choose the Kno-Draft *Adjustable* Air Diffuser for appearance. You can take performance for granted.

Better than words, the camera tells the story of Kno-Draft's quiet beauty . . . shows how, in their natural aluminum finish, these efficient diffusers can double as decorative accents. They can also be painted to blend with the ceiling . . . integrated with the lighting fixtures . . . used as smartly in traditional as in modern decor.

The performance you can take for granted is the *draftless* distribution of air throughout the conditioned area. Kno-Draft *Adjustable* Air Diffusers can be set, *after* installation, to produce the exact air flow pattern needed to assure balanced volume and even temperature. Their functioning is as unobtrusive as their good looks.

You can get Kno-Draft *Adjustable* Air Diffusers in suitable types and sizes for every job. And Connor Engineering Service will gladly work with you on any specifications.

**KNO-DRAFT DATA BOOK:** Complete specifications, engineering and installation data on Kno-Draft *Adjustable* Air Diffusers. To get your copy, simply fill in and mail the coupon. No obligation, of course.

REG. U. S. PAT. OFF.

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Danbury, Connecticut
*Air Diffusion • Air Purification • Air Recovery*
In Canada: Douglas Engineering Co., Ltd.,
190 Murray Street, Montreal 3, P. Q.

**W. B. CONNOR ENGINEERING CORP.**
**Dept. G-110, Danbury, Connecticut**

Please send me without obligation, my copy of the Kno-Draft Air Diffuser Data Book.

Name .....
Position .....
Company .....
Street .....
City ..... Zone ..... State .....

# YOU NAME IT!

**EVEN DISTRIBUTION OF HEAT**
Radiant and Convected heat from Vulcan finned tubes assures smooth distribution of warmth from floor to ceiling (less than 3 degrees differential).

**"FLEXIBILITY" IN INSTALLATION**
Vulcan fin tube radiation comes cut to any desired length in increments of 1 inch. Easy to specify for all types of building. Easiest to install, in high, low or hard-to-get-at places.

**EXPERIENCE**
Vulcan, pioneer manufacturer of fin tube radiation, has more than a quarter century of experience in the fabrication and application of line fin tube heating.

**HIGH OUTPUT**
*Vulcan Standard*, 2″ IPS-steel fins 4¼″ square; 1¼″ IPS-steel fins 3¼″ square, for installation in public buildings, churches, schools, hospitals and industrial plants.

**FOR HOMES, APARTMENTS**
*Vulcan Baseboard "Radi-vector,"* 1″ IPS-steel fins 2″ x 4½″, 1¼″ IPS-steel fins 2¾″ x 3¾″.

**FOR UNUSUAL WATER CONDITIONS**
Copper tubing with either copper or aluminum fins.

**EASE OF INSTALLATION**
Vulcan is light in weight, requires few fittings or supports, comes cut to desired length in increments of 1″.

**ECONOMY**
Installation costs may be materially reduced by using Vulcan Radiation.

**HIGH SAFETY FACTOR**
Seamless steel pressure tube, A.S.-T.M. Spec. A-83. Guaranteed for 450 P.S.I.

**TIGHT FINS**
Fins made integral with tube by mechanical expansion — no solder — guaranteed to remain tight under conventional operating conditions.

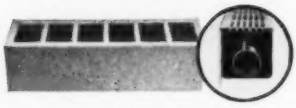
**NEAT APPEARANCE**
Attractive covers designed for the most pleasing effect, engineered for greatest heat output. (Combined radiation and convection.)

# VULCAN HAS IT!

VULCAN STANDARD

**Made in Canada under the tradename of Heal Radiation By The Vapor Car Heating Co. of Montreal.**

VULCAN BASEBOARD RADI-VECTOR



Linovector Cover Type F For Standard Radiation

Linovector Cover Type S For Standard Radiation

## AND DEPENDABLE SERVICE, TOO

**Below, a complete list of Vulcan Representatives. Recognized authorities on the application of Vulcan Radiation, they offer every customer real engineering knowhow and SERVICE in the fields of residential, commercial and institutional heating.**

**Albany, N. Y.**
G. W. Heacock & Co., Inc.
**Albuquerque, N. M.**
Boyd Engineering Co.
**Amarillo, Texas**
Snook and Aderton
**Atlanta, Georgia**
John A. Dodd Co.
**Baltimore, Md.**
F. C. Clifford
**Birmingham, Ala.**
Virgil A. Smith
**Boston, Mass.**
C. R. Swaney Co.
**Bridgeport, Conn.**
E. R. Clement, Inc.
**Buffalo, N. Y.**
Frank J. Weber & Assocs.
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Harry A. Pillen
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Tomlinson Steam Specialty Co.
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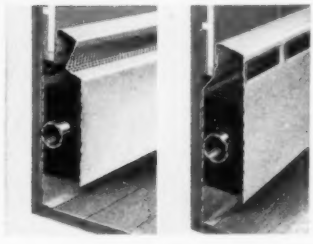
Uhl Co.
**Missoula, Mont.**
W. M. Walterskirchen
**New Orleans, La.**
Devlin Brothers
**New York, N. Y.**
A. F. Hinrichsen, Inc.
**Omaha, Nebraska**
D. E. McCulley
**Philadelphia, Pa.**
P. A. Cavanagh Co.
**Pittsburgh, Pa.**
Tutein Equipment Co.
**Portland, Oregon**
Norman S. Wright & Co.
**Richmond, Virginia**
Robert S. Lovelace
**Salt Lake City, Utah**
Midgley-Huber Co.
**San Francisco, Cal.**
Norman S. Wright & Co.
**Scranton, Pa.**
John P. Gilboy Co.
**Seattle, Wash.**
Norman S. Wright & Co.
**St. Louis, Mo.**
Bruce L. Evans Co.
**Washington, D. C.**
James P. Mewshaw

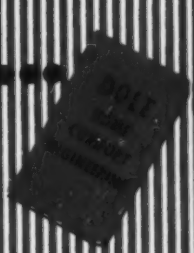


Above Left: Cutaway Showing Radi-vector with Type L Cover. Right: Type FSF Cover

Representatives in Principal Cities

**THE VULCAN RADIATOR COMPANY**
26 FRANCIS AVE., HARTFORD, CONN.

# Here's One for the Book...



FULLY AUTOMATIC

## DOLE-20

Dole No. 20 Hot Water Air Valves eliminate air from hot water radiators or convectors AUTOMATICALLY. They work equally well on new or existing heating plants with forced circulation or gravity systems. Easy to install — require no preliminary soaking — fully automatic.

Basement or Ceiling Main, High Point | Baseboard | Radiators | Convectors

...and Another

**DOLE CHAMBER VENT**

A combination fully automatic hot water air valve and air chamber. Specially designed for venting convectors, radiators, etc., on hot water heating systems. Three sizes cover most requirements. Write for specification sheets and prices.

...Still Another

**DOLE FLOW CONTROL VALVE**

A simple practical valve to regulate the flow of water. Limits the discharge to a pre-determined gallonage regardless of city water pressure from 15 to 150 lbs. p.s.i. No more cool water from over-drawn tankless heaters. Many other applications.

# All DOLE Achievements

■ CONTROL WITH DOLE

THE DOLE VALVE COMPANY — 723 Carroll Ave., Chicago 12, Ill.
Representatives in Principal Cities

"threads of strength"

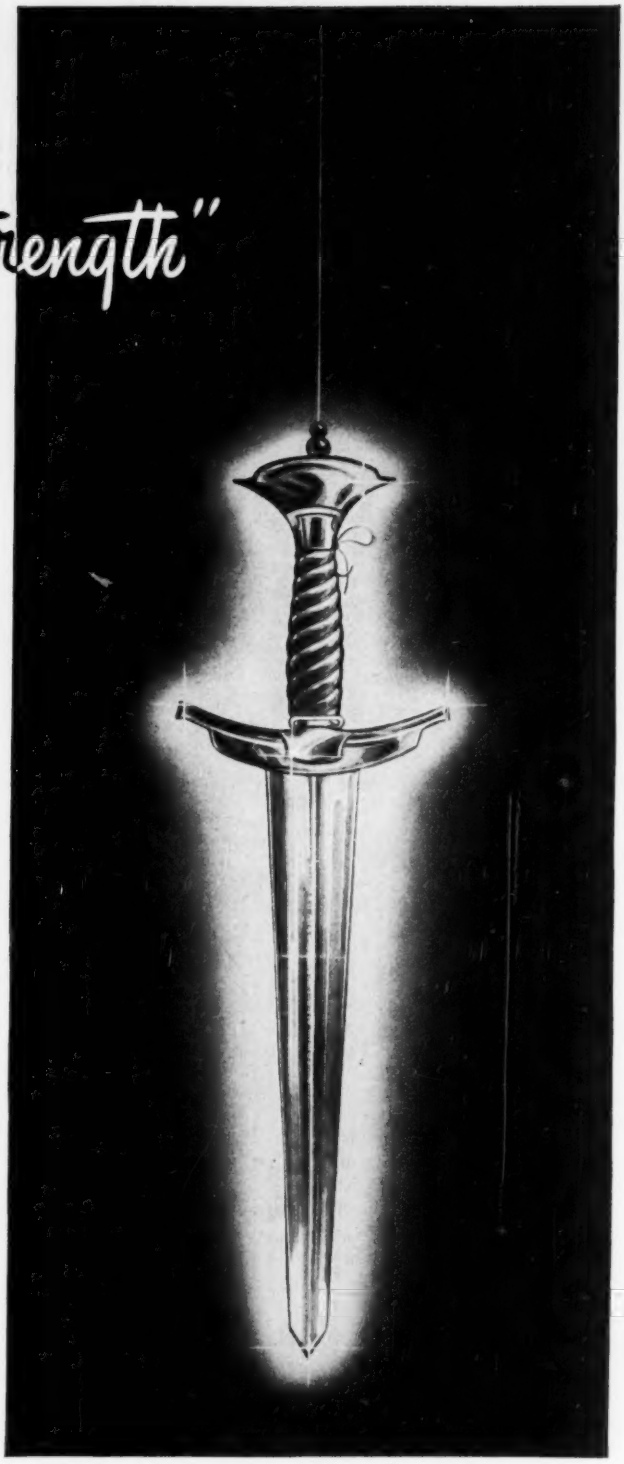
in
WHEATLAND
precision
COUPLINGS

Don't be like Damocles—use Wheatland precision couplings and *know* they will hold. The continuous even depth threads of these pressure tested couplings make pipe joints sure and safe. Made by men who know pipe and pipe problems.

precision couplings by

**WHEATLAND STEEL PRODUCTS COMPANY**

Bankers Securities Bldg., Philadelphia 7, Pa.



# Man..the things I've got to tell you!

It's good news the Bryant distributor has for you. Word on new products, new features, all to help you make better gas heating installations and better satisfied customers.

Take the story of Bryant boilers, made in thirty-five sizes, ranging from 67,500 to 3,996,000 Btu. Take the new heavy-duty conversion burner, fired by up to twelve injector torches, in capacities up to 1,500,000 Btu, ideal for large industrial and commercial conversions.

You'll hear, too, about Bryant unit heaters featuring the *Hevigage* steel heat exchanger, three times thicker than AGA requirements. You'll like the new Bryant all-weather conditioner, the packaged unit which brings year-round heating and cooling for store and restaurant installations . . . and the Bryant air dryer that gives greater efficiency to your air conditioning jobs.

You'll find all the facts in the new catalog, available through your Bryant distributor. So, make a date now with *the man who's got things to tell you!*

Let the pup be furnace man
. . . and water boy, too!

**bryant**

**AUTOMATIC HEATING**

The most complete line of gas heating equipment in the nation

Bryant Heater Div., Dept. 159,
Affiliated Gas Equipment, Inc.,
17825 St. Clair, Cleveland, Ohio

I'm interested! Please have your distributor furnish me with a copy of the new Bryant catalog.

Name_____

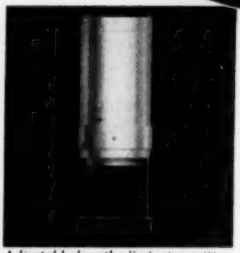
Company_____

Address_____

City_____ State_____

# HIGHER PROFITS
# SAFER VENTING

## WITH UL LISTED QC METALBESTOS GAS VENT



*Adjustable length eliminates cutting, speeds erection.*

*Adjustable elbows simplify installations.*

*Double-wall, all aluminum pipe assures correct venting.*

**More Installations per Hour . . .** More jobs can be finished per man each day than is possible with any other UL listed Type B gas vent. No special tools or skills are needed. Adjustable lengths permit fractional adjustments during and after installation . . . costly jigs, cutting and cementing of joints are eliminated. Single or multiple installations are finished faster and safer when you use QC Metalbestos.

**Easy to Handle . . .** A carton containing 45 feet of 4-inch Metalbestos weighs only 32 pounds. One man can load, stock-pile or install even the largest diameters without fatigue — can carry 90 feet of pipe at one time with ease.

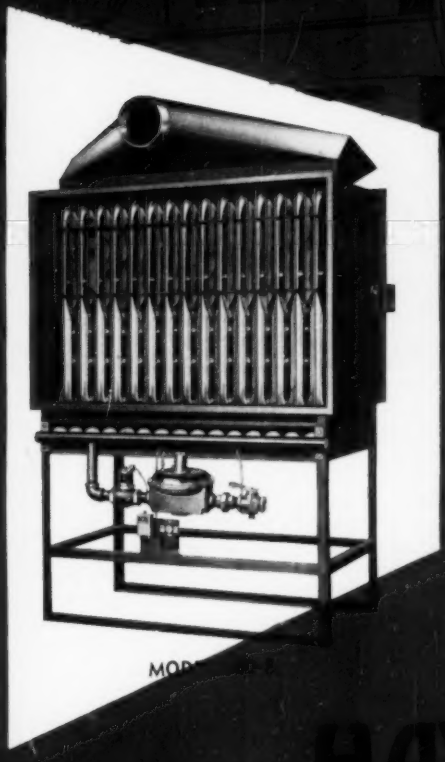
**Safe and Durable . . .** Precision manufacture assures automatic alignment, gas-tight joints and a completely safe installation. The pure aluminum inner wall attains efficient venting temperatures rapidly . . . condensation and sweating are held at a minimum. Maximum insulation and the high resistance of Metalbestos to weather and corrosion insure long years of trouble-free operation.

***REMEMBER** . . . Metalbestos Gas Vent meets or exceeds all safety requirements of the Underwriters' Laboratories for Type B gas vents.*

***Order from your local jobber or write to Dept. N***

**METALBESTOS DIVISION**

WILLIAM WALLACE COMPANY • BELMONT, CALIF.



MOD

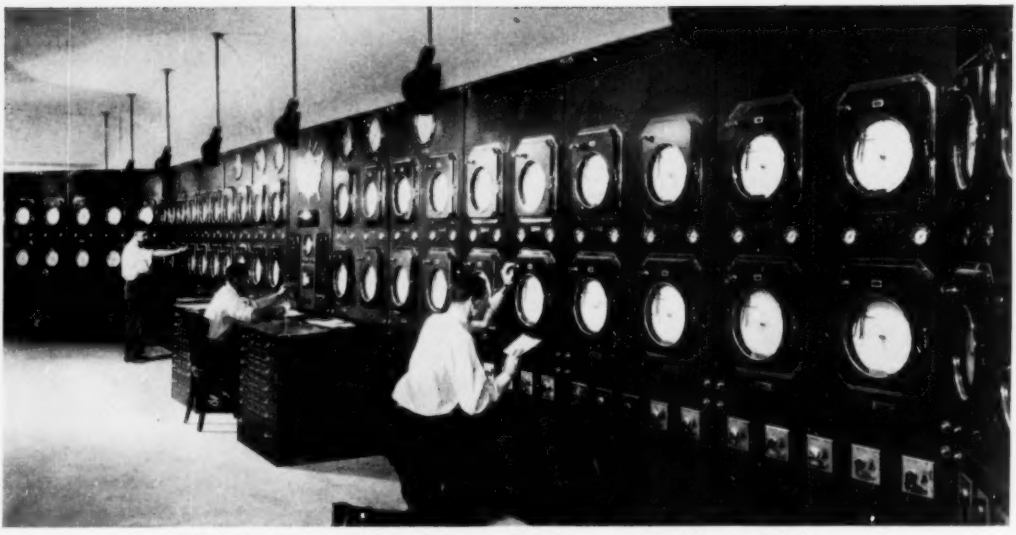
HAYES DUCT FURNACE SETS A NEW HIGH STANDARD FOR QUALITY . . .

HAYES DUCT FURNACE

HAYES FURNACE MFG. & SUPPLY CO.

# *16 years of Trouble-free*

# ±½° F. TEMPERATURE CONTROL AT NBC



*Taylor-Controlled Air Conditioning System at NBC, RCA Building, New York*

**RCA Building, New York, Nov. 18, 1950.** Without interruption for over 16 years, the Taylor-controlled central air conditioning system here has maintained ±½°F. in the National Broadcasting Company's offices and studios.

Completed in 1934, it was the first major air conditioning installation using Taylor Fulscope* Wet and Dry Bulb Controllers. "Almost human!" is the way it was described by the air conditioning engineer who specified the control system and supervised the installation.

16 years ago Taylor engineers were so confident of trouble-free service that temperature tube systems, some as long as 600 feet, were cemented into partitions in the RCA Building. That confidence came from tube system research, pioneered by Taylor 20 years prior to 1934. That same research has been routine throughout the years to bring you many new refinements in tube system design, plus new control instruments. Today Taylor gives you even greater assurance of trouble-free air conditioning.

Whether you're planning air conditioning for human comfort or product quality—or both, specify Taylor Instruments for the very finest in simplicity and dependability. Ask your Taylor Field Engineer! Or write Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada. *Instruments for indicating, recording and controlling temperature, pressure, humidity, flow and liquid level.*

*Registered Trade-Mark

**Taylor Instruments**
**MEAN**
**ACCURACY FIRST**
**IN HOME AND INDUSTRY**

# UNISTRUT Brings you the Best...

## IN MECHANICAL PIPING SUPPORTS!

NO DRILLING, NO WELDING, COMPLETELY ADJUSTABLE AND REUSABLE!

### pipe hangers

Pipe Strap
2" thru 8" IPS

Pivoted Hanger
2" thru 8" IPS

Clamp Hanger
½" thru 8½" OD

Suspension Hanger
2" thru 8" IPS

Bracket Saddle
2" thru 8" IPS

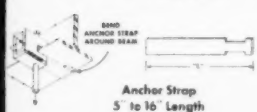
Saddle and Clamp
2" thru 8" IPS

### beam clamps

U-471
Max. Load 600 lbs.

U-235B
Max. Load 800 lbs.

U-71
Max. Load 1000 lbs.



Anchor Strap
5" to 16" Length

U-235A
Max. Load 600 lbs.

U-64
Max. Load 1200 lbs.

### brackets

P-4075

6" thru 24" Length

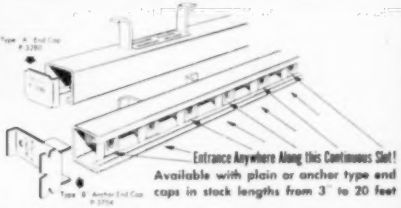
P-1593

P-1075

5" thru 18" Length

4½" thru 18" Length

### concrete inserts

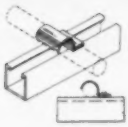


Available with plain or anchor type end caps in stock lengths from 3" to 20 feet

**LOAD DATA –** Recommended loading on inserts in average good concrete, with safety factor of 3, follows: P-3249—500 lbs. • P-3250—800 lbs. P-3251—1000 lbs. • P-3252—1200 lbs. • P-3253 thru P-3270—2000 lbs. per foot

### pipe clamps

Pipe Clamp
½" thru 8⅝" OD


1-Hole Clamp
¼" thru 1" OD

Parallel Pipe Clamp
⅜" thru 8" IPS

Half Pipe Clamp
2" thru 8" IPS

Full Pipe Clamp
2" thru 8" IPS

Tubing Clamp
⅜" thru 1" OD

### roller pipe supports

Pipe Block
2" to 8"

3-Roller Support
8" thru 16" OD
(2" dia. rollers)

2-Roller Support
1" thru 12" pipe size

Cast Iron Cable Saddle
0" thru 4¼" Cable

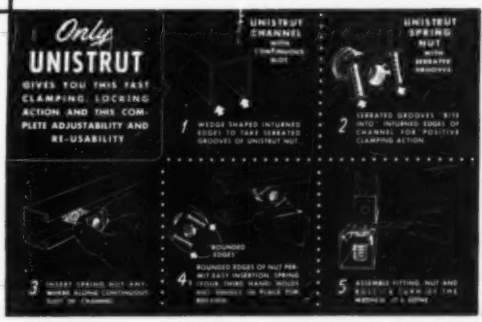
3-Roller Support
16" thru 36" OD
(3" dia. rollers)

2-Roller Support
8" thru 24" OD
(2" dia. rollers)

2-Roller Support
8" thru 36" OD
(3" dia. rollers)

2-Roller Support
8" thru 36" OD
(2" dia. rollers)

***Unistrut Fittings and Supports shown on this page combined with Unistrut Channel Provide the World's Most Flexible System of support or suspension***


Only
UNISTRUT
GIVES YOU THIS FAST CLAMPING, LOCKING ACTION AND THIS COMPLETE ADJUSTABILITY AND RE-USABILITY
UNISTRUT CHANNEL
UNISTRUT SPRING NUT
1 WEDGE SHAPED INTURNED EDGES TO TAKE SERRATED GROOVES OF UNISTRUT NUT
2 SERRATED GROOVES BITE INTO INTURNED EDGES OF CHANNEL FOR POSITIVE CLAMPING ACTION
3
4 ROUNDED EDGES OF NUT PERMIT EASY INSERTION, SPRING ACTION TWIST HAND HOLDS NUT TEMPORARILY ON PLACE FOR ADJUSTING
5

*Prompt Delivery from Warehouse Stocks in Principal Cities— consult your Telephone Directories*

U. S. Patent Numbers
2327587 2363382
2329815 2380379
2345650 2405631
Other patents pending

UNISTRUT
The World's Most Flexible All-Purpose Metal Framing

**UNISTRUT PRODUCTS COMPANY**
1013 W. WASHINGTON BLVD. • CHICAGO 7, ILLINOIS

## Free Catalog and Wall Chart!

**UNISTRUT PRODUCTS COMPANY**
1013 W. Washington Blvd.
Chicago 7, Illinois, Dept. H-11

Please send me your Construction Catalog No. 500 and Wall Chart, without obligation.

Name _____
Company _____
Address _____
City _____ Zone _____ State _____

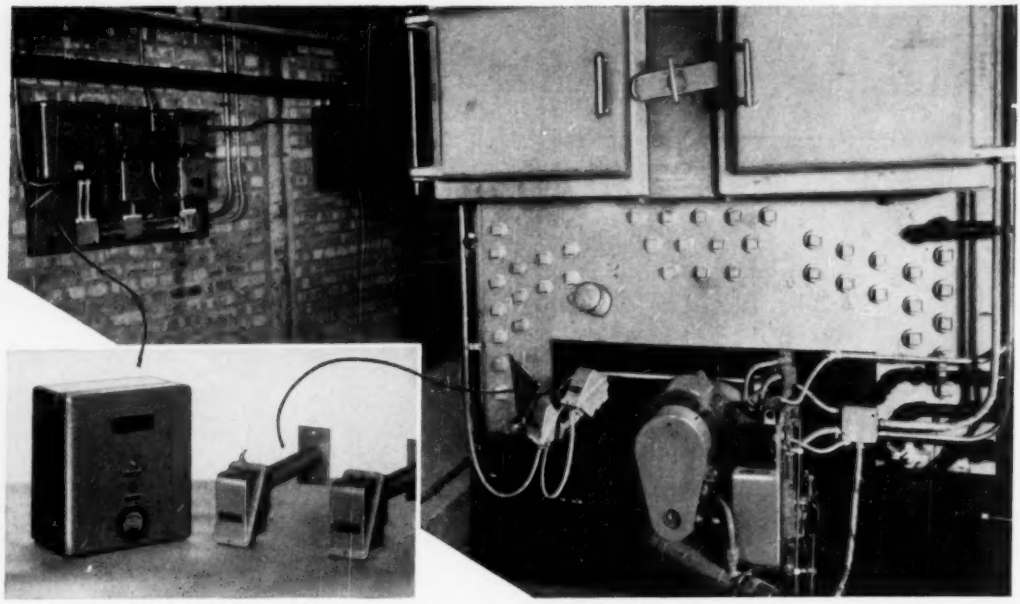
# NOW - Commercial Oil Burners

# PROTECTED 8 WAYS

## With G-E Electronic Oil Burner Control



G-E control components are compact, easily mounted, easily maintained—fully protected.



Photoelectric equipment means fewer moving parts, less maintenance. Here the phototube and electrode units are mounted at the side of the burner. A Tri-Clad® motor and transformer complete the all-General Electric system.

This photoelectric system provides a simple, effective method of controlling and protecting any type of commercial oil burner installation. Simple, easy to install, it offers fail-safe operation for long life, little maintenance. Approved by Underwriters' Laboratories and Factory Mutual.

### EVERY FEATURE A PROTECTION FEATURE

1. **Pilot Protection:** oil valve cannot open unless gas pilot has ignited.
2. **Flame Failure Protection:** photoelectric design assures almost immediate closing of oil valve in case of complete flame failure.
3. **Recycling:** if flame fails after starting, a timed "purging" period prevents immediate restart until explosive gases are cleared from the combustion chamber. The control then automatically recycles.
4. **Cold Oil Protection:** oil temperature thermostat can be used with circuit to assure correct temperature before starting cycle begins.
5. **Power Failure Protection:** program switch automatically recycles before oil valve can open upon return of power.
6. **Motor After-run:** purges nozzle or cup of unburned fuel minimizes carbonizing to reduce field servicing.
7. **Lock-out Indication:** cover light indicates ignition failure. Reset button must be pushed to restart system.
8. **Fail-safe Operation:** self-checking circuit prevents starting unless equipment is in proper condition.

**In Addition:** General Electric offers both motors and transformers for your commercial oil burner installation designed and time-proved for your equipment. The nearest G-E sales office will give you more information, or write for Bulletin GEA-4779. *Apparatus Department, General Electric Company, Schenectady 5, N. Y.*

®Reg. Trademark of General Electric Company.

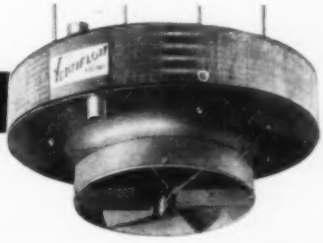
GENERAL ELECTRIC 730-13

# What's Your HEATING PROBLEM?

Young "SH" Unit Heater

## COLD SPOTS?

A favorite for general space heating and eliminating "cold spots" in large areas is the Young Type "SH" horizontal discharge unit heater. These non-ferrous-core units deliver maximum heat transfer . . . use quiet and efficient fans. Available in 14 sizes, with capacities ranging from 19,000 to 325,000 Btu per hour.



Young "Vertiflow" Unit Heater

## EXTRA HIGH CEILINGS?

Patented "Vertiflow" design offers a rugged, compact, highly efficient unit with low hp requirement. Its exclusive motor "ventilation" feature eliminates burn-outs from core heat. Seven sizes range from 52,600 to 552,000 Btu per hour, and cover larger areas quicker, with fewer units. Diffusers, nozzles, and Anemostats provide any heat pattern desired.

Young Cabinet Unit Heater

## DRAFTY AREAS?

Here's the ideal heating unit for lobbies, vestibules, auditoriums, etc. . . . wherever concentrated heating capacities are required and a compact, attractive exterior design is necessary. They are available in 3 sizes of each of 3 styles offering heating capacities ranging from 26,200 to 115,000 Btu per hour.

# YOUNG

Heat Transfer Products for Automotive and Industrial Applications.

Young Quality

Reg. U. S. Pat. Off.

Heating, Cooling, Air Conditioning Products for Home and Industry.

**YOUNG RADIATOR COMPANY**

Dept. 510-L RACINE, WISCONSIN

Plants at Racine, Wisconsin and Mattoon, Illinois
Sales and Engineering Representatives in All Principal Cities

**THIS COUPON BRINGS FULL DETAILS ON THREE SOLUTIONS TO HEATING DIFFICULTIES**

**YOUNG**
RADIATOR CO.
DEPT. 510-L
RACINE, WIS.

Rush me information on the following Young Unit Heaters:

☐ "SH" ☐ "Vertiflow" ☐ Cabinet

Name_____

Company_____

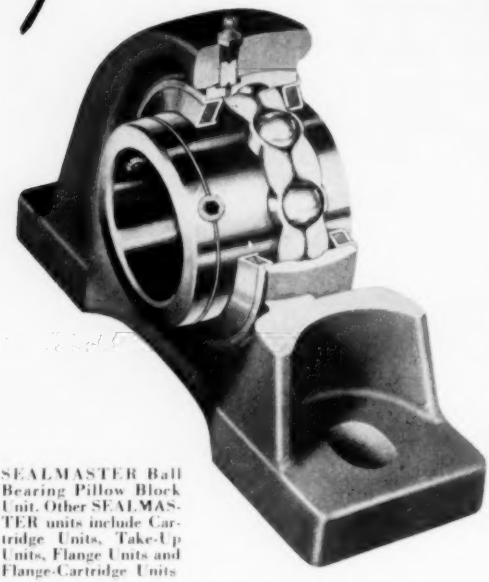
Address_____

City_____ Zone____ State_____

# PRODUCT PERFORMANCE

*Improve* *with*

## SEALMASTER
### BALL BEARING UNITS



SEALMASTER Ball Bearing Pillow Block Unit. Other SEALMASTER units include Cartridge Units, Take-Up Units, Flange Units and Flange-Cartridge Units

1 **Smooth, Quiet Operation**

2 **Minimum Maintenance**

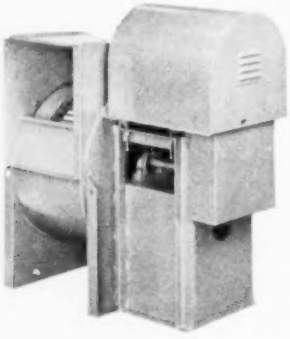
3 **Fast, Simple Installation**

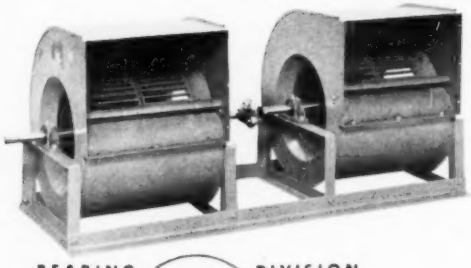
4 **Dependable, Long-term Service**

Manufacturers are finding through experience that SEALMASTER Ball Bearing Units definitely improve the performance of their products and give greater customer satisfaction. You'll soon discover that SEALMASTER units set new high standards of bearing efficiency and economy. Write us and request a copy of catalog 845 for your files . . . it gives the complete SEALMASTER story.

☆ **PERMANENTLY SEALED** ☆ **SELF-ALIGNING**

☆ **PRE-LUBRICATED** ☆ **NO HOUSING WEAR**





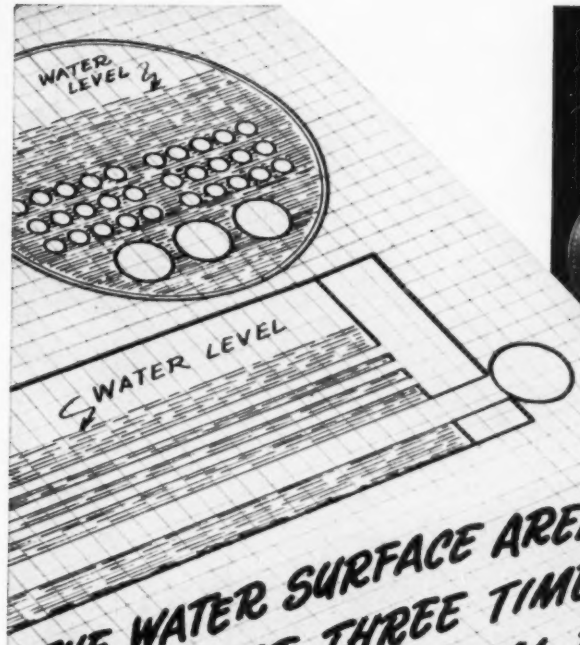
Master Fan units equipped with SEALMASTER bearings. Photos courtesy of Master Fan Corporation, Los Angeles, Calif.

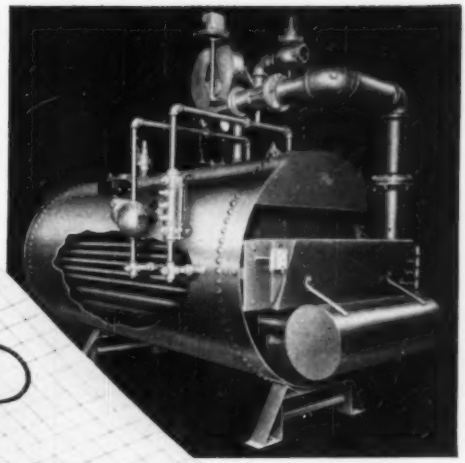
BEARING DIVISION

**STEPHEN S-A ADAMSON MFG CO.**

47 RIDGEWAY AVENUE, AURORA, ILLINOIS · LOS ANGELES, CALIF. ★ BELLEVILLE, ONT

*Factory Representatives and Dealers in All Principal Cities*



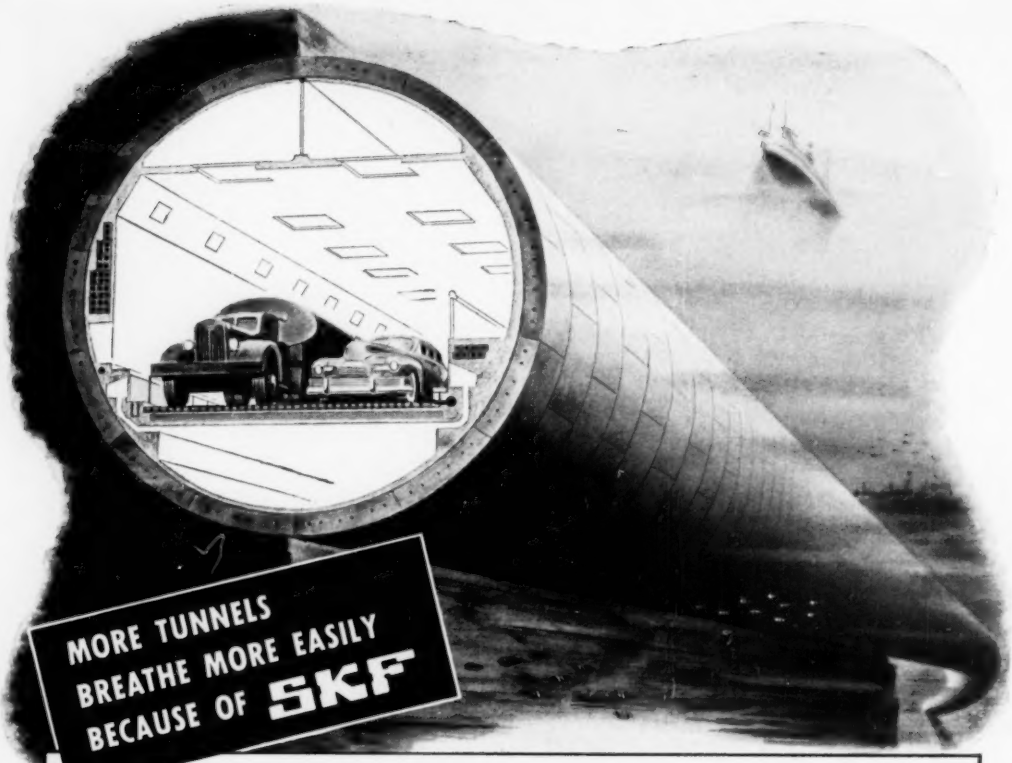
**THE WATER SURFACE AREA IS ALMOST THREE TIMES THAT OF A VERTICAL BOILER. THAT MEANS RAPID STEAMING AND DRY STEAM.**

With the firing tubes above the return tubes and all of them completely submerged, the surface water is heated first. That's why a Sellers Immersion Steam Boiler provides exceptionally fast steaming. Furthermore, this large area prevents surging . . . hence, dry steam. This is just another reason why this equipment can be depended upon for top efficiency and remarkably low operating cost. Write today for our Bulletin No. 1206-C. It contains full details about the 12 sizes available.

**Sellers**
**IMMERSION STEAM BOILERS**

**SELLERS ENGINEERING COMPANY**
**4876 N. Clark St., Chicago 40, Illinois**

Blast Heaters — Immersion Automatic Water Heaters — Air Heaters — Combustion Units — Industrial Gas Burners — Immersion Tank Heaters — Vertical Steam Boilers — Gas Combustion Equipment.




## TYPICAL SKF VEHICULAR TUNNEL INSTALLATIONS

| Location | Number of Fans | Fan Manufacturer |
|---|---|---|
| LINCOLN TUNNEL, New York – South Tube | 36 | Buffalo Forge Company |
| LINCOLN TUNNEL, New York – North Tube | 20 | Westinghouse Electric Corp. – Sturtevant Division |
| QUEENS MIDTOWN TUNNEL, New York | 46 | Westinghouse Electric Corp. – Sturtevant Division |
| GEORGE WASHINGTON BRIDGE APPROACH TUNNEL, New York | 8 | American Blower Corp. |
| PENNSYLVANIA TURNPIKE – 7 TUNNELS | 26 | Westinghouse Electric Corp. – Sturtevant Division |
| BANKHEAD TUNNEL, Mobile, Ala. | 3 | Clarage Fan Company |
| BROOKLYN BATTERY TUNNEL, New York | 53 | Westinghouse Electric Corp. – Sturtevant Division |
| BROOKLYN BATTERY APPROACH TUNNEL, New York | 12 | Westinghouse Electric Corp. – Sturtevant Division |
| WASHBURN TUNNEL, Houston, Texas | 5 | Westinghouse Electric Corp. – Sturtevant Division |

SKF Spherical Roller Bearings have been specified for most of the major tunnel-fan installations because they're self-aligning . . . long-lived . . . require infrequent lubrication and inspection . . . give continuous trouble-free service under highly adverse conditions. SKF *Industries, Inc., Philadelphia 32, Pa., the Pioneers of the Deep Groove Ball Bearing, Spherical Roller Bearing, Self-Aligning Ball Bearing.* 7073

SKF
BALL AND ROLLER BEARINGS

8 REASONS WHY SKF IS PREFERRED BY ALL INDUSTRY

INTEGRITY · CRAFTSMANSHIP · METALLURGY · TOLERANCE CONTROL · SURFACE FINISH · PRODUCT UNIFORMITY · ENGINEERING SERVICE · FIELD SERVICE

# Ladish Elbows

## ...A Complete Size Range Another Reason to Specify *Controlled Quality*

## SEAMLESS WELDING FITTINGS

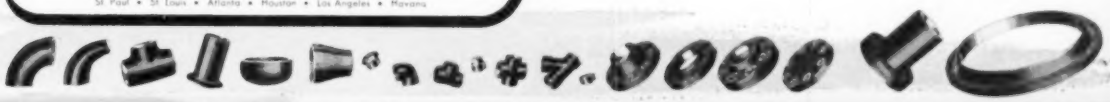
From the small fitting that weighs several ounces to the half-ton giant . . . whatever your fittings requirement, the Ladish line provides you with an unrestricted choice of sizes in a complete range of types, weights and materials. In addition, every fitting offers the added dependability assured by the high manufacturing and metallurgical standards of Ladish Controlled Quality.

THE COMPLETE FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

**LADISH CO.**

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

DISTRICT OFFICES: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago
St. Paul • St. Louis • Atlanta • Houston • Los Angeles • Havana



# They love us in New Orleans

Little wonder — considering how comfortable Carrier air conditioning keeps them. In sixteen of New Orleans' most important buildings, Carrier Centrifugal Refrigerating Machines furnish refrigeration for air conditioning.

Carrier Centrifugals are compact and light in weight. They are virtually vibrationless. In a city built on piling with almost no basement space, these advantages are of primary importance.

Your next project may have other requirements. Whatever they are, we are sure that Carrier equipment and Carrier experience can fill them with credit to you. You'll find a local Carrier office in the classified telephone directory. Carrier Corporation, Syracuse, New York.

**Carrier** AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

American Bank Building • Beverly Country Club • Canal Bank Building • Ear, Eye, Nose and Throat Hospital • Hibernia Building
Federal Land Bank Building • D. H. Holmes Company • International House • Maison Blanche Company • Municipal Auditorium
New Orleans Public Service • Orpheum Theatre • Roosevelt Hotel • St. Charles Hotel • Sears, Roebuck & Co. • Whitney Bank Building

**THESE PIPE LINES,** operating from 40°F. to 180°F., are being insulated with preformed sections of PC Foamglas. This efficient, long lasting insulation is also available in standard flat blocks, curved segments and beveled lags to fit many types of processing equipment. *Photo: Wire Building, Washington, D. C., Architect: Alvin Aubinoe. Insulation contractor: Standard Insulation Co. of Maryland, Inc., Baltimore, Maryland.*

*Cut down*
**INSULATION UPKEEP**

# . . . with PC Foamglas, the Long Life Insulation

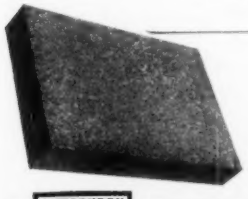
■ It takes a mighty *effective* insulation to keep any heating and cooling system running effectively. And it takes a mighty *economical* insulation to keep it running economically. That is why so many engineers are installing PC Foamglas in walls and floors, roofs and ceilings of commercial, industrial and public buildings, on indoor and outdoor piping, on tanks, ducts and other air handling equipment.

Its cellular glass structure makes PC Foamglas an effective insulation. Millions of minute sealed glass cells form an efficient barrier to heat travel, thus help to maintain desired temperatures, to control humidity, to minimize condensation.

Then too, being glass, Foamglas has unusually high resistance to moisture, vapor, acid atmospheres and other elements that cause some materials to lose insulating efficiency. It is noncombustible, odorless and verminproof. Consequent freedom from repairs, maintenance and replacement makes PC Foamglas a truly economical insulating material.

Whether your immediate requirements concern structural, piping or equipment insulation, it will pay you to know all the advantages you get with PC Foamglas. Our specialists will be glad to consult with you regarding your individual insulating problems.

Meanwhile, our literature will give you complete information and specifications on the usual applications of Foamglas. Just check and send in the convenient coupon today. Your free copies of our booklets and folder—and a sample of the material—will be mailed to you promptly.



**This is FOAMGLAS®**

The entire strong, rigid block is composed of millions of sealed glass bubbles. They form a continuous structure which has unusually high resistance to moisture, vapor and acid atmospheres, is noncombustible, verminproof and odorless. In those closed glass cells, which contain still air, lies the secret of the material's long life insulating efficiency.

Pittsburgh Corning Corporation
Dept. RR-110, 307 Fourth Avenue
Pittsburgh 22, Pa.

Please send me without obligation, a sample of Foamglas and your free folders on the use of PC Foamglas Insulation for:

Industrial, Commercial and Public Buildings ☐. Piping and Equipment ☐. Refrigerated Structures ☐. Home Insulation ☐.

Name.....

Address.....

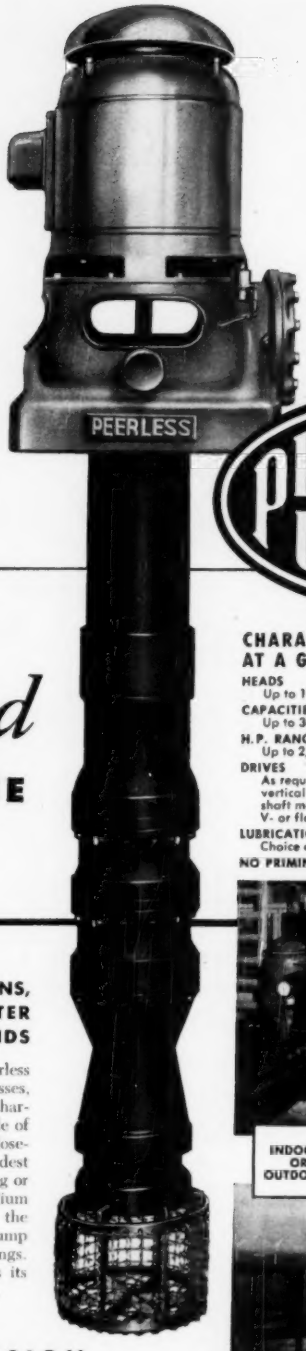
City.....State.....

PITTSBURGH ® PC CORNING **FOAMGLAS INSULATION**

***. . . when you insulate with FOAMGLAS . . . the insulation lasts!***

# ALL THE CAPACITY
# ALL THE VERSATILITY
# ALL THE POWER
# ALL THE EFFICIENCY

**OF A DEEP WELL PUMP FOR SHORT OR MEDIUM SETTINGS**




**REQUEST FREE BULLETIN**
Describing and illustrating Peerless close-coupled pumps. Request Bulletin B-159.

PEERLESS PUMPS

## PEERLESS *Close-Coupled* VERTICAL TURBINE PUMPS

**CHARACTERISTICS AT A GLANCE:**

**HEADS**
Up to 1000 feet

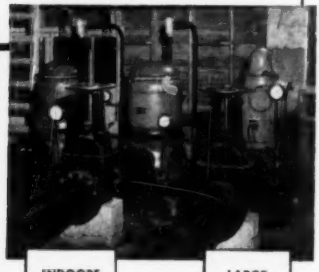
**CAPACITIES**
Up to 30,000 g.p.m.

**H.P. RANGE**
Up to 2,500 h.p.

**DRIVES**
As required; standard electric vertical hollowshaft or solid shaft motors; right angle gear drive; V- or flat belt; combination units.

**LUBRICATION**
Choice of oil or water lubrication.

**NO PRIMING PROBLEMS**



INDOORS OR OUTDOORS

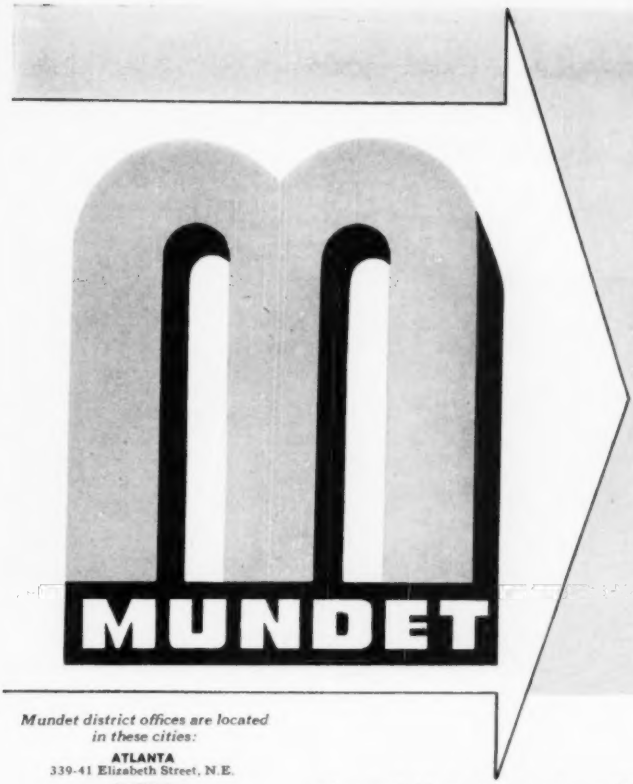
LARGE OR SMALL

### SPACE SAVING VERTICAL PUMP FOR BASINS, SUMPS, RESERVOIRS AND SURFACE WATER SOURCES SUCH AS RIVERS, LAKES, PONDS

This successful, close-coupled, modification of the Peerless vertical deep well turbine pump, for industrial processes, embodies all the outstanding design and performance characteristics which have made Peerless the leader in the sale of vertical, deep well turbine pumps. Peerless vertical close-coupled turbine pumps are economically applied to a widest range of municipal, industrial and commercial water lifting or boosting and circulation processes, where short or medium pump settings are involved. Plan with Peerless to get the power, capacity and utility of this vertical space-saving pump that will cut your pump overhead with measurable savings. Descriptive Bulletin No. B-159 describes and illustrates its design, performance and applications, write for it today.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION

*Factories:* Los Angeles, California, and Indianapolis, Indiana.
*Offices:* New York, Atlanta, Chicago, St. Louis, Phoenix, Fresno, Los Angeles; Dallas, Plainview and Lubbock, Texas; Albuquerque, N. M.




# NEW

## HEAT SAVING EFFICIENCY

### with Mundet Custom Molded 85% Magnesia

*Mundet district offices are located in these cities:*

**ATLANTA**
339-41 Elizabeth Street, N.E.

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**PHILADELPHIA 39**
856 N. 48th Street

**ST. LOUIS 9**
3176 Brannon Ave.

**SAN FRANCISCO 7**
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*In Canada:*
Mundet Cork & Insulation, Ltd.
35 Booth Avenue, Toronto

Now available in pipe covering and block insulation, Mundet Custom-Molded 85% Magnesia permits new heat-saving efficiency.

You benefit from these advantages when you use Mundet 85% Magnesia Insulation.

- ***Easier to Apply***
  It cuts easily and cleanly, even without canvas support. No chipping, crumbling or "powdering." Blocks score cleanly.
- ***Lighter Weight***
  Only 11 lbs. per cubic foot density. Even larger sizes and thicknesses are easy for one man to handle.
- ***Controlled Uniformity***
  Precision manufacture on the latest type of equipment insures uniform standards.
- ***More Durable***
  Greater "ductile strength" is built into the insulation. It does not "powder," settle or disintegrate even with heavy vibration. It withstands handling and may be removed and reapplied if necessary.
- ***Does not Shrink or Warp***
  Steam or water leakage does not affect it. It does not shrink or warp even after soaking.
- ***Attractive Smooth Finish***
  No unsightly, inefficient "bagging." Mundet 85% Magnesia insulation retains its neat appearance and effectiveness.
- ***Precision Pipe Fit***
  No spaces are left for the escape of heat. The whole heated surface is snugly enclosed.

Write for specification information and recommendations. Mundet Cork Corporation, Insulation Division, 7207 Tonnelle Avenue, North Bergen, N. J.

**INSULATION FOR HIGH AND LOW TEMPERATURE**

# MARSH *throughout*

## . . . in this new Men's Residence Center at INDIANA UNIVERSITY

**ARCHITECTS**
Burns & James, Indianapolis, Indiana
**MECHANICAL ENGINEERS**
Bevington, Taggart and Fowler, Indianapolis, Indiana
**HEATING-CONTRACTORS**
Freyn Bros. Inc., Indianapolis, Indiana

At an open house party held last November, well wishers of Indiana University attended the formal unveiling of this impressive, new 4½-million dollar men's residence center occupying five acres of the campus at Bloomington, Indiana.

What they saw heightened their traditional hoosier pride. Inside the massive H-shaped building they found 522 comfortable rooms for men students; 18 sunny lounges; a welcoming 120 x 40-foot main lounge with large adjoining library and administrative offices; a 16,000 sq. ft. dining room large enough to seat all residents at one time.

They also found ideal heating comfort. Special emphasis had been placed on the heating phase; and judicious engineering, excellent equipment and expert installation had combined to achieve ideal heat distribution with maximum efficiency and economy.

As in so many critically engineered heating systems Marsh heating specialties were used throughout. The traps included a large number of Marsh float and thermostatic traps as well as inverted Bucket traps. The job was basically hot water, so of course hundreds of Marsh radiator valves were used in the system.

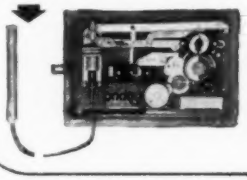
The selection of Marsh equipment here is one more example of the preference accorded Marsh in scores of large and exacting jobs. It will pay you to insist on this equipment that is always first choice where only the best is good enough. Ask for new bulletins.

Hundreds of Marsh Packless Radiator Valves were used in the large hot water distribution system.

A large number of Marsh Float and Thermostatic Traps like this were used.

**BIG SAVINGS when the heat control is MARSH TRI-TROL**

For multiple occupancy buildings of any size TRI-TROL is the simple low-cost, easily installed regulator, giving control "in step with the weather" that means ideal heating comfort at minimum cost. Ask about it.



**MARSH HEATING EQUIPMENT CO.**
Sales affiliate of Jas. P. Marsh Corporation
DEPT. T SKOKIE, ILL.

**MARSH** *Heating Specialties* **SINCE 1865**

# There's an EASIER WAY

**...To Open a Sardine Can**

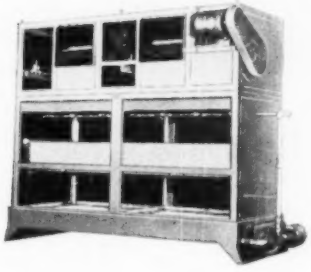
**...Or to "Get Into" Heat Transfer Air Units**

***Always Specify***

**KENNARD** *Engineered*

**EVAPORATIVE CONDENSERS**
**COOLING TOWERS**
**AIR CONDITIONING UNITS**

# *for ACCESSIBILITY*



Quality-built KENNARD units seldom require servicing. However, on the rare occasions when servicing is necessary, you'll appreciate Kennard's multiple service and access panels, permitting servicing from any or all of FIVE sides—all parts readily accessible.

In addition to convenience in servicing, ALL Kennard Engineered products have exclusive "built in" features to provide maximum service at minimum cost.

These are the reasons why so many architects and engineers specify "KENNARD"—the quality line with ALL of these advantages—Penta-Post frame construction, non-corrosive metal screws, nuts, bolts and washers; solid bronze latches, non-corrosive coil frames and hydraulically 3000 psi expanded scale free coils.

*"Refinement of Detail Marks the Difference Between Ordinary and Excellent."*

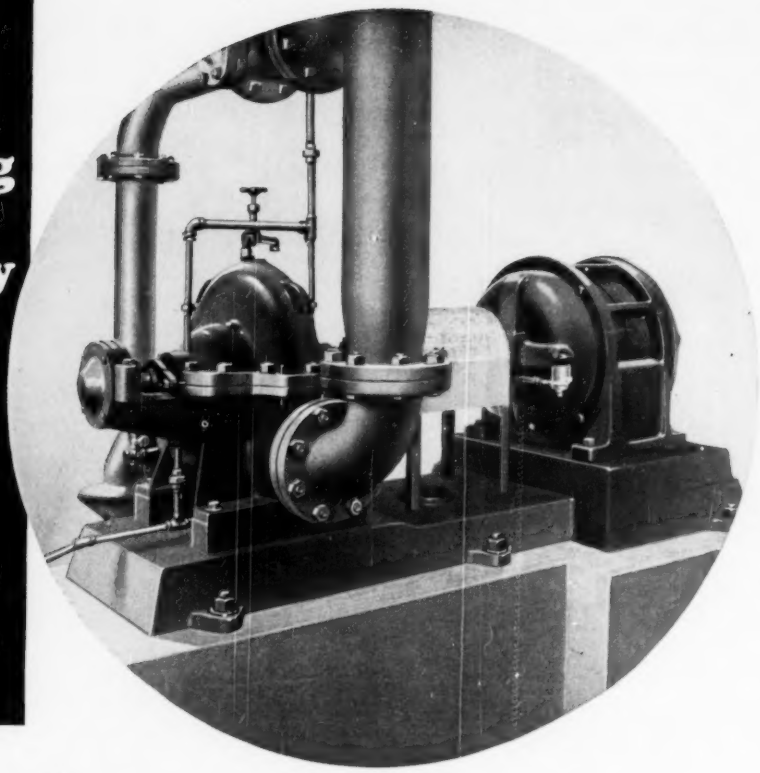
***Write for Bulletins...***

**No. 47A—FINNED COILS**
**No. 486—AIR CONDITIONING BLOWER UNITS**
**No. 491—EVAPORATIVE CONDENSERS**
**No. 494—COOLING TOWERS**

**KENNARD CORPORATION** • **1817 S. HANLEY ROAD ST. LOUIS 17, MISSOURI**

**Pumping with Economy**

*A Midwest Utility Reports:*



# "Only minor maintenance over 3500 hours service"

**Recirculating water at 100°, PH 5.0, this Economy 6" x 5" Type M double suction centrifugal pump replaced a conventional pump that did not stand up under the corrosive effect of water laden with tar acids, light oils, fly ash and small amounts of suspended silt. The user of this all-bronze Economy pump, a large mid-west utility, reports satisfactory service . . . minor maintenance.**

**Longer service with less maintenance is typical of Economy Pumps. Many improvements in design, workmanship and materials contribute to their higher efficiency, greater dependability and longer life.**

**For complete details on Economy Type M double suction pumps, write Dept. C-11 for Catalog A-1147. For competent engineering advice on any pumping problem, call on your Economy Pump Representative.**

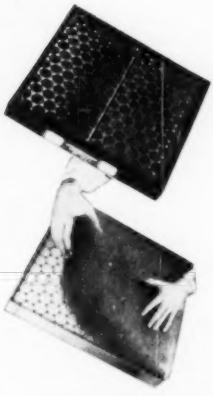
**Centrifugal, axial, and mixed flow pumps for all applications.**

**Economy Pumps Inc.**

**DIVISION OF HAMILTON-THOMAS CORP. HAMILTON, OHIO**

Glasfloss Air Filters hold more dust at higher efficiency with less resistance to air because the filter pad is made of incredibly fine glass fibres. Fibres as fine as human hair are assembled in a fluffy, resilient mass with an intricate maze of air passages. The long, curly glass fibres provide greater surface area so that Glasfloss air filters actually stop more dust while allowing free air circulation.

## Glasfloss Air Filters meet every need!



**STANDARD DISPOSABLE TYPE.** Glasfloss Air Filters are made for all types of central heating, ventilating, and air conditioning systems. The standard disposable type in the chipboard frame is supplied in all standard sizes for use both in home heating equipment and in commercial or industrial filter banks. The light, fluffy texture of the filter pad permits maximum penetration of dirt without clogging the pad and imposing extra loads on the equipment.

**REFILL TYPE IN REUSABLE METAL FRAMES.** For large industrial filter banks the Glasfloss refill type air filter effects considerable economies—as much as 30% of standard filter replacement costs! The lightweight reusable metal frames are easily refilled with fresh pads because the pads are as fine and soft as silk. With the Glasfloss refill type filter, there is no longer any economy in re-processing dirty pads for re-use—the fresh, clean new refills cost so little!

**BOTH TYPES GIVE BETTER AND MORE ECONOMICAL FILTERING PERFORMANCE THROUGH THE USE OF LONG, FINE GLASS FIBRES**

Once you see the light, fluffy texture of the Glasfloss filter element, you will see why Glasfloss air filters last longer, hold more dirt. Send for complete information. Address Dept. HP.

Glasfloss 155 EAST 44th STREET, NEW YORK 17, N. Y.

NO, Doctor, there is no scientific laboratory formula for media selection. But experienced space buyers do have an effective and time-proven recipe for the profitable investment of advertising money—reasoning, judgement and experience PLUS THE USE OF FACTS. The basic advertising values of publications are reflected in the facts about their circulations. Also there are definite standards, mutually approved by buyers and sellers of advertising, by which circulations may be uniformly measured. Hence circulation facts, when reported in accordance with these standards, provide a dependable guide to sound advertising investments.

The information that makes it possible to measure advertising values based on circulation facts is given in the reports issued by the Audit Bureau of Circulations, a cooperative and nonprofit association of 3300 advertisers, advertising agencies and publishers. The Bureau has a staff of experienced, specially trained circulation auditors who make annual inspections and audits of the circulations of the publisher members. The factual data thus obtained is issued in the A.B.C. reports which are available to advertisers and agencies for use in comparing and selecting media.

Guesswork and waste in advertising are avoided when media is selected on the basis of the facts in A.B.C. reports. This business paper is a member of the Audit Bureau of Circulations. Ask for a copy of our A.B.C. report.

*The audited information in A.B.C. reports for business papers includes the following:*

**How much paid circulation.**
**How much unpaid circulation.**
**Prices paid by subscribers.**
**How the circulation was obtained.**
**Whether or not premiums were used as circulation inducements.**
**Where the circulation goes.**
**A breakdown of subscribers by occupation or business.**
**How many subscribers renewed.**
**How many are in arrears.**

**SEND THE RIGHT MESSAGE TO THE RIGHT PEOPLE**

Paid subscriptions and renewals, as defined by A.B.C. standards, indicate a reader audience that has responded to a publication's editorial appeal. With the interests of readers thus identified, it becomes possible to reach specialized groups effectively with specialized advertising appeals.

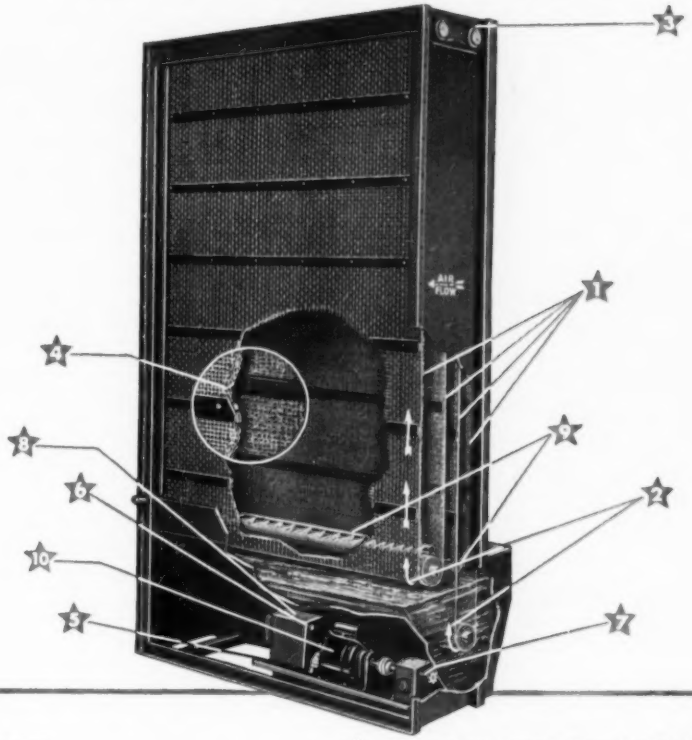
## HEATING, PIPING & AIR CONDITIONING

**A.B.C. REPORTS — FACTS AS THE BASIC MEASURE OF ADVERTISING VALUE**

# STAYNEW AUTOMATIC

*No other Air Filter can give you these*

## 10 IMPORTANT FEATURES

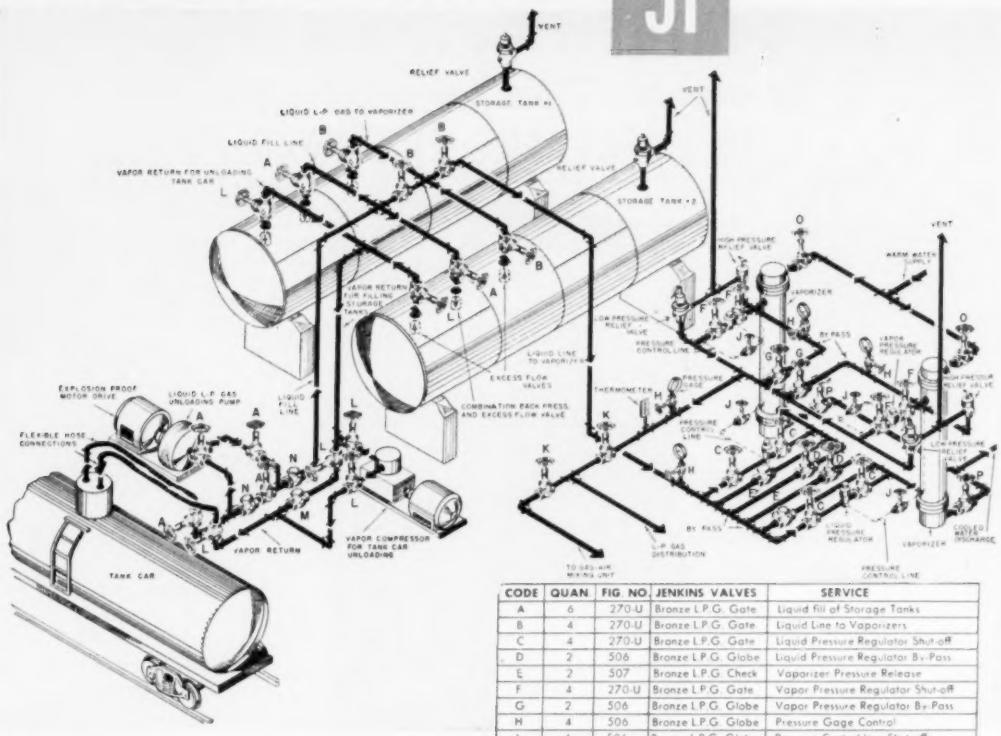



1. Double Filter Curtains.
2. Direction of Curtain Travel such that *cleaned* panels are *always* on downstream or filtered air side.
3. Gear and Roller Chain Drive. *No belts to slip.*
4. Highest Efficiency of any mechanical type self-cleaning filter plus exceptionally large dust-handling ability.
5. Motor and Control Unit mounted on *clean* air side of filter.
6. Momentary Contact Time Switch for testing and checking curtain travel and compressed air control.
7. Shear Pin Protection of moving parts from accidental damage.
8. Control Mechanism arranged as an integral part of filter unit or for remote mounting.
9. Compressed air curtain cleaners available for special conditions.
10. Nation-wide Service on both motor and controls.

# DOLLINGER CORPORATION

9 CENTRE PARK — DOLLINGER THE PROTECTOMOTOR STAYNEW FILTERS — ROCHESTER 3, N. Y.

## JENKINS PRACTICAL PIPING LAYOUTS 51




| CODE | QUAN. | FIG. NO. | JENKINS VALVES | SERVICE |
|---|---|---|---|---|
| A | 6 | 270-U | Bronze L.P.G. Gate | Liquid fill of Storage Tanks |
| B | 4 | 270-U | Bronze L.P.G. Gate | Liquid Line to Vaporizers |
| C | 4 | 270-U | Bronze L.P.G. Gate | Liquid Pressure Regulator Shut-off |
| D | 2 | 506 | Bronze L.P.G. Globe | Liquid Pressure Regulator By-Pass |
| E | 2 | 507 | Bronze L.P.G. Check | Vaporizer Pressure Release |
| F | 4 | 270-U | Bronze L.P.G. Gate | Vapor Pressure Regulator Shut-off |
| G | 2 | 506 | Bronze L.P.G. Globe | Vapor Pressure Regulator By-Pass |
| H | 4 | 506 | Bronze L.P.G. Globe | Pressure Gage Control |
| J | 4 | 506 | Bronze L.P.G. Globe | Pressure Control Line Shut-off |
| K | 2 | 270-U | Bronze L.P.G. Gate | Distribution System Shut-off |
| L | 6 | 270-U | Bronze L.P.G. Gate | Vapor Return for Tank Car |
| M | 1 | 507 | Bronze L.P.G. Check | Prevent Vapor Backflow |
| N | 2 | 507 | Bronze L.P.G. Check | Prevent Liquid Backflow |
| O | 2 | 47 | Bronze Gate | Warm Water Supply |
| P | 2 | 106-A | Bronze Globe | Cool Water Discharge |

### How to plan a
# STORAGE AND VAPORIZER HOOKUP FOR LIQUEFIED PETROLEUM GAS

**PETROLEUM GAS,** (propane, butane, etc.) liquefied at atmospheric temperatures by moderate pressures, is shipped by tank car to local storage plants. Diagram shows piping and equipment used in vaporizing and storing these gases.

**THE LIQUEFIED GAS** is unloaded into storage tanks with the use of liquid pump and vapor compressor. The compressor draws vapor from the tank and returns it to the tank car at a slightly higher pressure, forcing out the remaining liquid. This passes through a regulating valve, to the vaporizer where steam or hot water heating converts it to vapor.

**THIS GASEOUS FUEL** is then piped through a pressure regulator which assures a constant pressure, and on to the gas distribution system or gas-air mix unit. Duplicate vaporizers provide continuous service in case of breakdown. Safety relief valves are vented to the atmosphere. Check valve on vaporizer inlet acts as a relief valve when vaporizer pressure exceeds that of tank.

Consultation with accredited piping engineers and contractors is recommended when planning major piping installations.

**A CHOICE OF OVER 500 VALVES**

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering, select all the valves you need from the Jenkins Catalog. It's your best assurance of *lowest cost in the long run.*

Jenkins Bros., 100 Park Avenue, New York 17; Jenkins Bros., Ltd., Montreal.

**NEW BOOK OF PIPING LAYOUTS, Nos. 26 to 50**
A new book of Jenkins Practical Piping Layouts — Nos. 26 to 50 — including above, is in preparation. Mail coupon to get your copy when ready.

**JENKINS BROS., 100 Park Ave., New York 17, N.Y.**
Reserve copy of New Piping Layout Book for

Name _____

Company _____

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_____

JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864

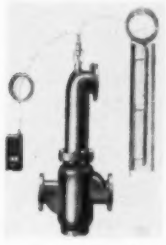
# EQUIPMENT DEVELOPMENTS...

*For your convenience in obtaining more information about any of this equipment, see coupon on this page. Add the new products and companies listed here to your Directory Section which you received in your January 1950 Heating, Piping & Air Conditioning and thus keep your records of sources of supply up to date throughout the year. Single asterisk indicates equipment not listed in Directory Section; double asterisk, equipment and manufacturer not listed*

### Modulating Control for Hot Water Heating

HPAC 1—The Type ST-1 modulating outdoor control of Sarcotherm Controls, Inc., Empire State Bldg., New York 1, is a self contained automatic mixing valve adapted to recirculate to the hot water heating system a varying portion of the return water, adding automatically the correct amount of hot water from the boiler or convertor to maintain desired radiator or coil temperatures.

A liquid expansion thermostat is mounted on an outside wall of the building, usually with a northwest exposure. The thermostat is connected by flexible tubing to the valve operator which forms a part of the thermostatic system so that the position of the mixing valve is determined by the combined influence of the outside temperature at the bulb and that of the mixed water flowing. Single seated valves are available in sizes from ¾ to 2½ in. with a cast iron body and screwed connections. The 3 to 6 in. sizes are furnished with double seated valves designed to operate with a positive closing action even though the differential pumping head is large. Bodies of these units are of cast iron with flanged connections.



Heating Control

Axial Flow Fan

### Axial Flow Fans

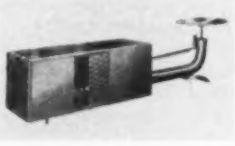
HPAC 2—The new class 2000 axial flow pressure blowers of Moore Co., Marceline, Mo., are recommended for use on cooling towers, both forced and induced draft, as well as in all types of duct installations where large quantities of air are required under static pressures up to 4 in. of water.

The complete blower is designed and constructed as a unit, including the special direct drive motor which is mounted within the hub and housing. According to the company, units are tailor assembled for any one of an infinite number of performance requirements. From standard parts, a unit of given diameter with from two to nine blades, set at one of various angles, may be provided. In addition, guide vanes are set to provide axial discharge. The rotor, to which the wheel is attached, is mounted on two permanently greased and sealed bearings lubricated with silicone grease. The slow speed motors have been designed specifically for these units. They are said to provide unusual efficiencies, together with low starting current and low starting torque characteristics.

Units may be furnished in carbon steel, monel metal, stainless steel, or any other workable metal available in sheet form. Blowers are offered in two size ranges: Series 16 units, with a 16 in. hub, in diameters from 3 ft to 5 ft; series 24 units, with a 24 in. hub, in diameters from 4 ft to 8 ft. Belt drive units are available.

### Gas Conversion Burner

HPAC 3—A gas conversion burner designed to permit rapid and easy conversion of industrial and commercial heating plants is now available from Norman Products Co., Inc., 1150 Chesapeake Ave., Columbus, Ohio.



The unit embodies the same basic design, but in larger proportions, as the company's domestic burners and is said to be particularly suitable for converting apartment house and commercial heating plants, process steam boilers, etc. A feature is the use of the company's single port, self piloting flame-retention principle. The telescopic burner tube is said to permit easy adjustment for burying depth. The unit is equipped with adjustable front and rear leveling legs and a cast chromium distributor plate. Controls are AGA approved and are housed beneath the removable end cover. The three models have capacities of 500,000, 750,000, and 1,000,000 Btu per hr.

FOR YOUR CONVENIENCE [11-50]

Heating, Piping & Air Conditioning
6 N. Michigan Ave., Chicago 2, Ill.

Please ask the manufacturers to send me more information about the equipment mentioned under the following reference numbers in Equipment Developments and Recent Trade Literature

*(Circle each HPAC number in which you are interested)*

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 |
| 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | | |
| 101 | 102 | 103 | 104 | 105 | 106 | 107 | 108 | 109 | 110 |
| 111 | 112 | 113 | 114 | 115 | 116 | 117 | 118 | 119 | 120 |
| 121 | 122 | 123 | 124 | 125 | 126 | 127 | | | |

Name ..... Title .....

Company .....

Address .....

City ..... Zone ... State .....

### Packaged Boiler

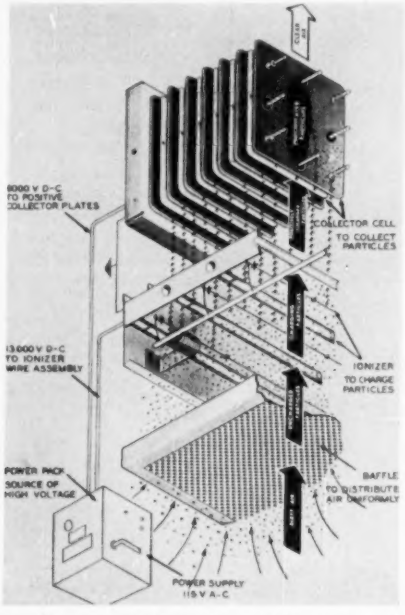
HPAC 4*—A completely shop assembled boiler, ready to place, connect, and operate, has been added to the line of self contained steam generating units for power, process, and heating services offered by Babcock & Wilcox Co., 85 Liberty St., New York 6.

It is recommended for both small and large establishments such as industrial and process plants, office buildings and apartment houses, schools and hospitals, etc. Known as the "integral-furnace" boiler, type FM, the new unit is produced in standard sizes for loads ranging from 7000 to 25,000 lb per hr of steam at pressures up to 250 psi.

It is a water tube boiler, with a completely water cooled furnace, and is shipped and delivered as a unit. The boiler is operated with push-button start and stop, and automatic control for handling variations in load. Designed for continuous service, it may be fired by oil, gas, or combination oil and gas burners. According to the manufacturer, the changeover from one fuel to another is easily made.

### Electrostatic Air Cleaner

HPAC 5—A new "Precipitron" electronic air cleaner, constructed for upward or downward air flow to conserve floor space and simplify maintenance, is now available from Westinghouse Electric Corp., Sturtevant Div., 200 Readville St., Hyde Park, Boston 36.


8000 V D-C TO POSITIVE COLLECTOR PLATES
COLLECTOR CELL TO COLLECT PARTICLES
13000 V D-C TO IONIZER WIRE ASSEMBLY
IONIZER TO CHARGE PARTICLES
POWER PACK SOURCE OF HIGH VOLTAGE
BAFFLE TO DISTRIBUTE AIR UNIFORMLY
POWER SUPPLY 115 V A-C

Designed to remove dust, dirt, smoke, soot, and other airborne solids from normal air, the new unit charges the solid particles positively, then passes the air through a set of alternately charged collector plates where the solids are removed by electrostatic attraction.

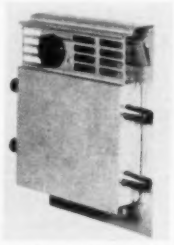
The vertical air flow cleaner is recommended for use in heating and air conditioning systems, and for oil-mist collection. It is available in capacities of 1200 cfm and up.

### Baseboard Heating Unit

HPAC 6—The steel cover of the standard baseboard heating unit of Kritzer Radiant Coils, Inc., 2901 W. Lawrence Ave., Chicago 25, has been redesigned to increase convection output, and a new damper for controlling the warm air is now supplied with the baseboard when specified.

A control knob is installed in damper equipped baseboards to regulate dampers up to 10 ft in length. The additional warm air output is said to be obtained because of added "chimney effect" achieved by the redesigned louvers.

The "Fin-Tube" coil is enclosed within the baseboard and consists of aluminum fins mechanically bonded on two copper tubes through which hot water is piped. The cover plate snaps in place.


Baseboard Heating Unit

Tankless Heater

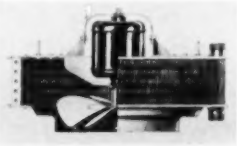
### Tankless Water Heaters

HPAC 7—Bell & Gossett Co., Morton Grove, Ill., is offering two new tankless water heaters. These can be furnished as a standard unit without the jacket, or as a deluxe unit with an insulated metal jacket. They are constructed with a cast iron shell and a spiral copper tube bundle.

Capacities range from 3½ to 5 gpm when the water is heated from 40 to 140 F and boiler water is at 180 F. For 200 F boiler water, capacities are 5 to 7½ gpm.

### Projection Unit Heaters

HPAC 8—The Trane Co., La Crosse, Wis., has redesigned its line of projection type unit heaters. The overall dimensions remain the same, but an offset roll has been added to the bottom to give added rigidity and improved appearance. Only the motor and housing brackets protrude beyond the top of the unit. All bracing is done beneath the top plate for added strength. It is now possible to remove the motor either through the top of the unit or through the discharge orifices on larger models.



A new hydraulically expanded coil is used on these units. The tubes are expanded under pressure of 3000 psi. A companion device is the new "Louver Cone" diffuser designed to provide fingertip adjustment for an almost infinite variety of air distribution patterns.

The new series includes a new model, No. 275-P which has a 35 in. fan and a 451,000 Btu capacity. Capacities for other models range from 55,300 Btu for the No. 100-P to 550,000 Btu for No. 300-P.

# NEVER Ventilate a Ceiling or Wall Space to the Inside...

*If you do, the better the insulation, the worse will be the condensation; for the colder the air in the space between insulation and roof, or walls, the less vapor can it support.*

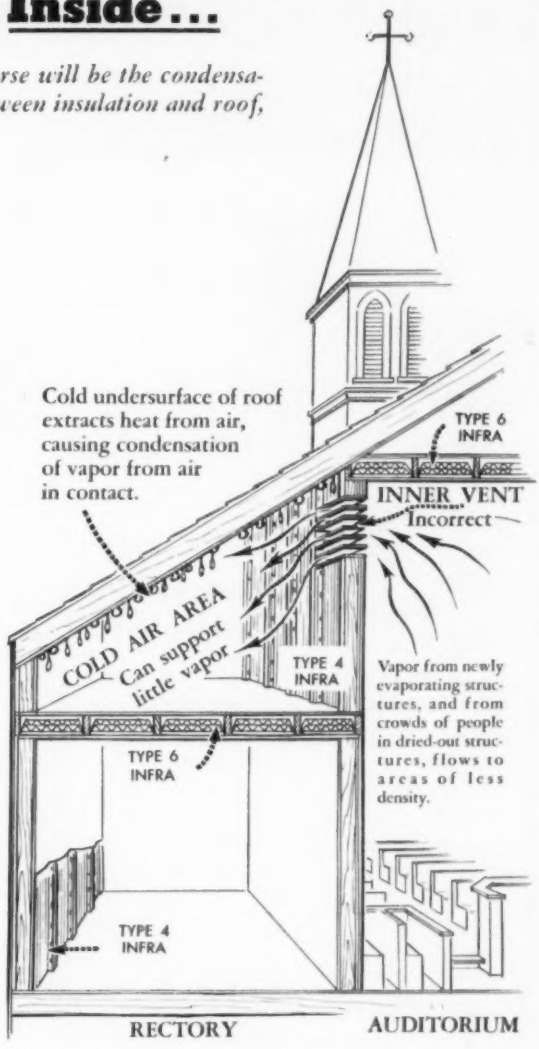
In new construction, thousands of tons of cement and plaster are evaporating. Vapor flows from areas of greater density into this small, cold space, an area of less vapor density and small capacity.

Multiple sheets of accordion aluminum, because impervious to vapor, force out through exterior walls and roofs, ordinary amounts of fortuitous vapor formed from rain leaks, etc. With unusual amounts of vapor, as from crowds, in theatres, schools, stores, etc. provision should also be made to vent this vapor to the *outside.*

**In the illustration, an actual case, it was recommended that the inner vents above the insulation be eliminated. More details about this frequent error and other data on vapor flow and condensation sent on request.**

Three-sheet accordion aluminum, permanently separated by fiber partitions, is commercially available as Type 6 Infra, and costs less than 9¢ sq. ft., material with labor, installed between wood joists in new construction.

Get valuable FREE copy of new, revised "Simplified Physics of Vapor and Thermal Insulation," authoritative, simply written 44-page manual. Covers heat and vapor flow, condensation, radiant heating, radiation, convection and conduction. Tells how to test insulations yourself and experiment with heat flow. Contains chart of *k*, C, R, and U factors of all insulations, of all thicknesses, weights, densities.


Cold undersurface of roof extracts heat from air, causing condensation of vapor from air in contact.
TYPE 6 INFRA
INNER VENT Incorrect
COLD AIR AREA Can support little vapor
TYPE 4 INFRA
Vapor from newly evaporating structures, and from crowds of people in dried-out structures, flows to areas of less density.
TYPE 6 INFRA
TYPE 4 INFRA
RECTORY
AUDITORIUM

**THERMAL FACTORS, TYPE 6 INFRA**

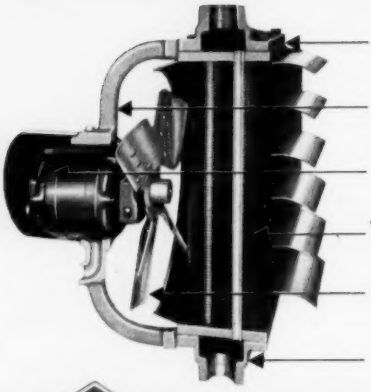
**Down-Heat C.044, R22.72 equals 7½" DRY Rockwool**
**Up-Heat C.080, R12.50 equals 4" DRY Rockwool**
**Wall-Heat C.073, R13.69 equals 4½" DRY Rockwool**
**VAPOR PERMEABILITY equals ZERO**

**INFRA INSULATION, INC.**
**10 Murray Street New York, N. Y.**
**Telephone: COrtlandt 7-3833**

INFRA INSULATION, INC.
10 Murray Street, New York, N.Y. Dept. H-11
Please send "Simplified Physics of Vapor and Thermal Insulation."
Name_____
Firm_____
Address_____
☐ Send Prices of Infra Insulations ☐ Send Sample

"3-SHIFT" OPERATION IS ON THE WAY!...

*Get Unit Heaters that can take it!*


Two-Piece graduated header
Cast frame keeps parts aligned
Self-Cooled Motor never "slow-roasts"
All copper core—no brazing, no soldering
Dynamically balanced fan wheel
Bottom header "floats"

ILG UNIT HEATERS

**Made to stand up under continuous day and night operation without breakdown**

Plant operators during World War II thanked their lucky stars when they had ILG Unit Heaters installed. For these rugged, highest quality units delivered heat 'round-the-clock to keep production rolling . . . with a minimum amount of service or maintenance. Under ordinary conditions, the ILG units last for decades, making each heating dollar go further. Send coupon, or call nearby Branch Office (consult classified directory) for latest data and prices.

***SEND FOR FREE BROCHURE***
**"Performance is the Pay-Off!"**

**ILG ELECTRIC VENTILATING CO.**
**2841 North Crawford Avenue, Chicago 41, Ill.**
**Offices in more than 40 Principal Cities**

☐ Please send me a copy of your FREE BROCHURE "Performance is the Pay-Off!"

Company Name _____

Executive's Name _____ Title _____

Address _____ Zone _____

City _____ State _____

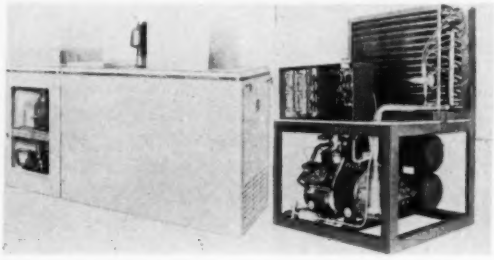

### Pipe Joint Compound

HPAC 9—Hercules Chemical Co., 332 Canal St., New York City, is marketing a new pipe joint compound recommended for screw joints on steam, gas, water, air and ammonia lines and for piping carrying dilute acids and alkalies.

Outstanding advantages are said to include no oil separation, no running upon application, no hardening in the can, and no freezing of joints.

### Air Conditioners

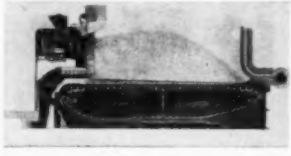
HPAC 10*—Meyer Furnace Co., Peoria 1, Ill., has added a new line of summer air conditioners designed for use in conjunction with its "Weir-Meyer" furnaces, or with any other warm air furnace. These "Marvellaire" units are used to cool offices, stores, and other places of business.



The line is available in six sizes—2, 3, 5, 6, 8, and 10 tons. Conditioners correspond to the width and heighth of the company's deluxe gas and oil fired lo-boy furnaces; however, the units may also be used with the company's hi-boys or with any line of warm air furnaces. Features are said to include a reciprocating, totally enclosed compressor, a five row staggered tube coil, and cleanable type shell and tube condenser. The furnace fan is utilized to circulate the cool air. The 6, 8, and 10 ton units are furnished with dual compressors, each operating as a single unit with its own section of coil and condenser.

### Spreader Stoker

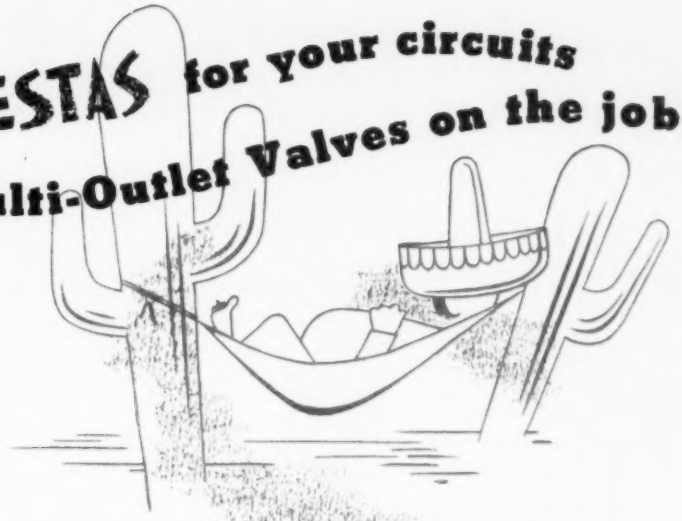
HPAC 11—A spreader type stoker with traveling grate designed to meet the requirements of medium to large industrial plants and central stations is available from Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30. These stokers have a fuel burning capacity covering a range of from 30,000 to over 350,000 lb per hr of steam.



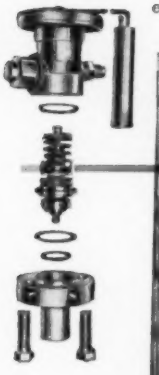
Efficient, economical combustion of any bituminous coal and lignite is said to be obtainable with this stoker. Coal is spread by a hydraulic motor driven overthrow rotor so that it falls over the entire length of the fuel bed. The forward moving traveling grate discharges ashes continuously at the front and air seals are designed to permit ample opening between the grate and bottom of front wall for the discharge of ash.

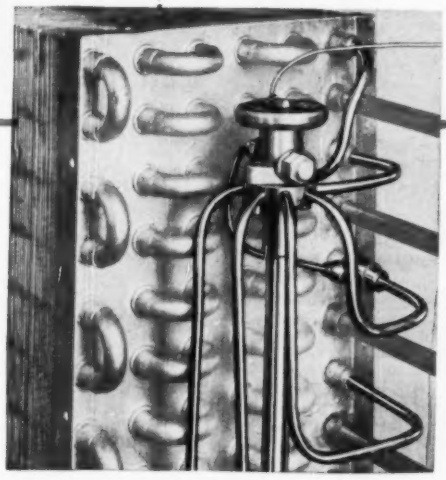
Coal is fed to each rotor by two "long stroke", constant

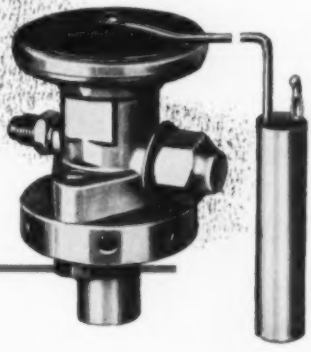
# NO SIESTAS for your circuits with Alco Multi-Outlet Valves on the job



Loafing coils waste 1/3 to 1/2 of your coil capacity. Wake 'em up—keep 'em working full time—with ALCO Multi-Outlet Valves that provide an individual outlet for every circuit!







Here's why they *more* than pay for themselves:

**1** Refrigerant accurately metered *at point of expansion*

**2** Constant *full* coil capacity—regardless of load changes

**3** Pin-point control—no wasteful "hunting" or "cycling"

**4** Longer "off" cycle—saves current and wear on compressor

For all refrigerants, all requirements. ½ to 50 tons "Freon-12", 2 to 36 outlets. Full details in Bulletin 180.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

25 YEARS

A QUARTER-CENTURY OF PIONEERING AND PROGRESS

**ALCO VALVE CO.**

861 KINGSLAND AVE. • ST. LOUIS 5, MO.

SEE YOUR ALCO WHOLESALER

IRON BULWARK

AGAINST CORROSIVE FLUIDS

Fairbanks®

all iron gate valves

...are made of high-test alloy iron to withstand the action of many of the strongest chemicals such as concentrated sulfuric acid, alkalies, aniline oils, sodium and potassium cyanides and creosote. These iron body valves give long service under the severe operating conditions that exist with use of these destructive agents.

Fairbanks All Iron Gate Valves—like those in all Fairbanks lines—are low in maintenance cost, easy to operate and long-lasting in service ...a real answer to cost-cutting needs today.

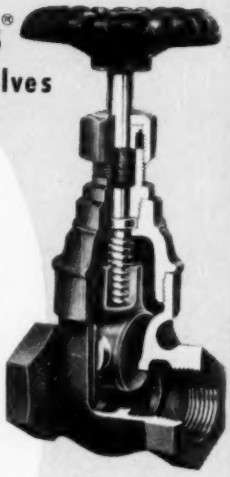


Fig. 0318
ALL IRON GATE VALVE
150# SWP 225# WOG
Non-Rising Stem • Solid Wedge • Taper Seat
½"-2" Sizes

Fig. 0904
ALL IRON GATE VALVE
125# SWP 200# WOG
Solid Wedge • Taper Seat • Malleable Iron Seat Rings
2"-12" Sizes

Fig. 0418
IRON BODY U-BOLT GATE VALVE
150# SWP 225# WOG
Bronze Mounted • All Iron Rising Stem • Solid Wedge • Taper Seat
½"-4" Sizes

For handling other types of corrosive fluids such as dry carbon dioxide, ethyl acetate, malt beverages, propane and butane gas use FAIRBANKS BRONZE SOLDER END and FAIRCO-BRAZE (silver-brazed) VALVES.

For full details consult your distributor or write direct

THE Fairbanks COMPANY

393 LAFAYETTE STREET • NEW YORK 3, N. Y.

Branches: New York 3 • Pittsburgh 22 • Boston 10 • Rome, Ga.

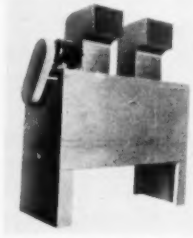
CASTERS • TRUCKS • VALVES • DART & PIC UNIONS


velocity rams and a coal feed equalizer plate driven from continuous uniform feed whether the coal is wet or dry. An integrated hydraulic drive system for fuel feed, fuel distribution, and grate drive provides a synchronized drive with independent control and adjustment for each element.

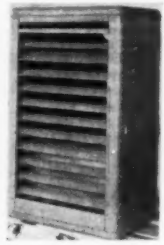
### Blower Type Unit Heater

HPAC 12—A new blower type unit heater available in eight models with capacities from 35,000 to 2,000,000 Btu per hr and with air deliveries from 1200 to 33,000 cfm, is offered by United States Air Conditioning Corp., 33rd and Como Ave., S.E., Minneapolis 14.

The heater is composed of a basic blower section with the heating coil attached. The blower section can be rotated to face the outlets in any direction, and outlet cowls can be attached to the blower outlets in any of four positions. In addition, units may be inverted, floor, ceiling or wall mounted. Self aligning flange type bearings are incorporated in a two-bearing design and are mounted outside the housing. Fan blades are of the forward curved type. According to the manufacturer, the unit is ideally suited to large area heating, because of its wide flexibility, ease and economy of installation and operation.



Blower Type Unit Heater



Gas Fired Heater

### Gas Fired Unit Heater

HPAC 13—The new UHS suspended type unit heater of John Zink Co., 4401 S. Peoria St., Tulsa, Okla. is AGA approved for natural, mixed, manufactured or LP gas. It is available in three sizes with input ratings from 75,000 to 190,000 Btu per hr.

Designed for horizontal air throw, heaters are equipped with a propeller type fan, motor, fanguard, safety shutoff, gas pressure regulator (except on liquefied petroleum gas units), solenoid valve and thermostat.

### Arc Welding Ground Clamp

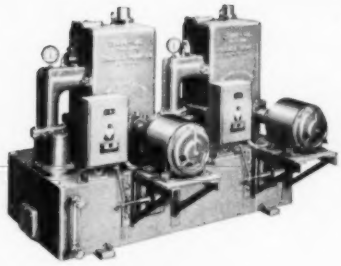
HPAC 14—A new light weight, low cost ground clamp of 300 amp capacity, the GC-3, has been developed by Lincoln Electric Co., Cleveland 1.

It is designed to provide a convenient, readily movable, yet solid ground connection. The clamp weighs 1½ lb and has a jaw spread of 2½ in. A heavy direct acting spring gives a positive connection with the work and the frame is made of pressed steel.

There Is A

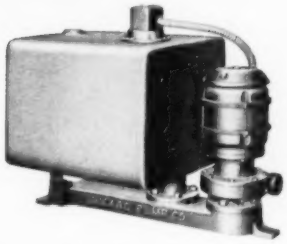
# CHICAGO PUMP

## For Every Heating Service In All Types of Buildings



### "CONDO-VAC" VACUUM AND BOILER FEED PUMP

Picture Shows Duplex "Condo-Vac" with Duplex Automatic Control. Single units also furnished. "Condo-Vac" Vacuum Pumps are used as return line condensation, vacuum and boiler feed pumps, for vacuum heating systems. Also used for industrial services where condensation and gases are to be handled. For either intermittent or continuous duty.



### "SURE RETURN" CONDENSATION PUMP AND RECEIVER

Single "Sure Return" shown. Duplex units are also furnished. Designed specifically to return HOT water to the boiler. It will not steam-bind because pump suction is always under a head and suction opening is unusually large. Capacities up to 35,000 EDR and up to 50 lbs. pressure.

### "AVC" CONDENSATION PUMP AND RECEIVER

Pumps for 500 to 10,000 EDR and 10 to 50 pounds pressure. "AVC" Condensation Pumps and Receivers are simple, high grade, well-engineered, sturdy units. They occupy only a small space, with low installation cost. "AVC" Pumps are conservatively rated as to capacity and motor load.

### VERTICAL CONDENSATION PUMP AND RECEIVER

Installed in the ground to take the condensation from return lines that come back below the floor and pump them back to the boiler. Capacities up to 40,000 sq. ft. direct radiation and up to 26 lbs. pressure.

## CHICAGO PUMP COMPANY

**BUILDING and INDUSTRIAL DIVISION**

**2300 WOLFRAM STREET** — **CHICAGO 18, ILLINOIS**

Condo-Vac, Sure Return, AVC, LVC
Fire, House & Circulating Pumps
Pneumatic & Tankless Water Systems

Flush-Kleen Sewage Ejectors
Little Giant & Non-Clog Bilge Pumps
Pumps for every industrial use.

**because it does man-sized jobs**

*A mighty midget* is this Ward Leonard 105 Relay!

It's frequently used on jobs normally requiring heavier-duty relays. Certain types are Underwriters-approved as motor controls.

Unique spring suspension adds a self-cleaning action to the oversize silver-to-silver contacts. Note how the posts are securely anchored in the base—another typical Ward Leonard feature.

Write for Bulletin 105. WARD LEONARD ELECTRIC CO., 24 South Street, Mt. Vernon, N. Y. Offices in principal cities of U. S. and Canada.

**WARD LEONARD ELECTRIC COMPANY**

*Result-Engineered Controls*

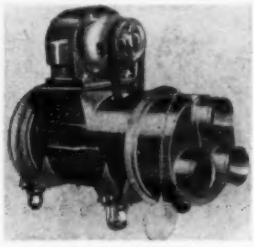
RESISTORS • RHEOSTATS • RELAYS • CONTROL DEVICES

### High Pressure Steam Traps

HPAC 15—New, small forged steel steam traps have been developed by V. D. Anderson Co., 1949 W. 96th St., Cleveland 2, for high pressure, superheated steam service. Units are designed for pressures up to 500 psi with 800 F total temperature and have ½ in. or ¾ in. pipe connections.

The traps are said to have unusual safety features, as the head and body are of forged steel to withstand shock and explosions. The internal parts are of stainless steel with the valve and seat made of "Anderloy", a special alloy developed by the company for steam service. The gasket is recessed to prevent blowing out. Units incorporate the company's "Super-Silvertop" features, such as a guided bucket for positive valve closing and a minimum of moving parts.

Steam Trap



Portable Blower

### Portable Blower

HPAC 16—Developed primarily to expel explosive fumes from gasoline tank cars and trucks before interior repair welding is done, a specially designed application of its standard 12 in. vaneaxial blower has been developed by the Hartzell Propeller Fan Co., Piqua, Ohio.

Said to be compact, light in weight and extremely flexible, it is mounted on industrial-type swivel casters, can be lifted by one man, and may be rolled from job to job.

One end assembly is built with three air outlets, with shutoff gates, so that one, two or all three can be used at the same time. Thus full air delivery can be concentrated in one large tank, or up to three small compartments can be blown out at the same time. Each outlet delivers approximately 500 cfm through 15 ft of 5 in. hose with a right angle bend. The end assemblies can be reversed to pull in air, as is often done while welding is in progress.

### Room Cooler

HPAC 17**—The "Cooler-Aire" room cooler of Baltimore Porcelain Steel Corp., P. O. Box 928, Baltimore 3, Md., is said to feature small size, compactness, light weight, portability, and noiseless operation.

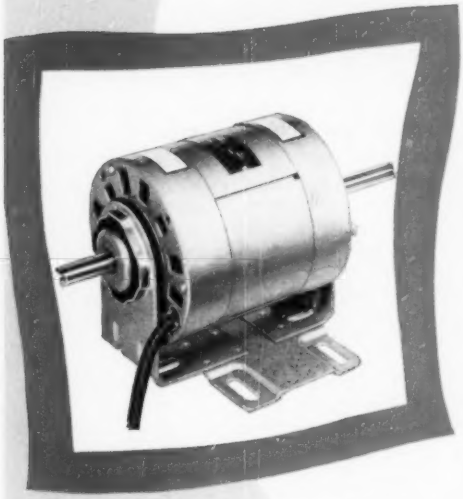
The unit is designed to condense moisture in the room and remove it to the outside in such a way that it cannot be recirculated back into the room. The motor and condenser are located entirely outside the room so that motor heat and noise are not introduced into the room.

The 0.6 hp hermetically sealed condensing unit is said to have a capacity nearly the equivalent of most ¾ hp air conditioners. The complete unit weighs slightly over 100 lb.

RAYTHEON

fractional hp motors

# dependable performance



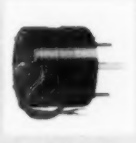
TYPE #470 6-pole, 1050 rpm, 1/15 to 1/8 hp. New economy model featuring drawn steel end bells with self-aligning bearings. Helps you cut production costs—for example you can get the Type #470 at about ½ the cost of comparable capacitor motors, or ⅔ the cost of split phase motors. Typical example of Raytheon "New Principle" design and Creative Electronic Craftsmanship. Write for Bulletin #4000.

"Count on Raytheon to run it." Design engineers have learned to rely on Raytheon fractional hp motors when they want to *run* things—for example, FANS, BLOWERS and AIR CONDITIONING EQUIPMENT.

Raytheon Creative Craftsmanship assures *Dependable Performance* at the shaft—the kind of trouble-free power unit that manufacturers need in today's competitive markets.

Call in your Raytheon representative for consultation on your specific application.

RAYTHEON Type 230 Shaded 2-pole 1/200 to 1/50 hp at 3200 rpm motor.



RAYTHEON Type 330-S Shaded 4-pole 1/200 to 1/10 hp 1550 rpm motor.

RAYTHEON Type 350 Shaded 2-pole, 1/40 to 1/6 hp at 3000 rpm motor.

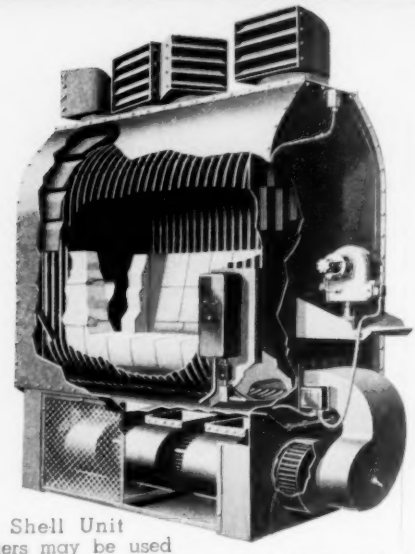
QUALITY R PRECISION

RUSSELL ELECTRIC COMPANY

MOTOR DIVISION OF RAYTHEON MANUFACTURING CO.

4501 So. Western Boulevard Dept. K-28 Chicago 9, Illinois

LEE SHELL UNIT HEATER



Lee Shell Unit Heaters may be used singly or as a central system with the heated air distributed through ducts.
The efficiency of Lee Counter-current flow reduces fuel consumption while the rugged simplicity of the system decreases cost of installation, assures low maintenance charges and provides ventilation without additional cost.

The LEE line . . .
Steel Encased Tubular Heater
Tubular Unit Heater
Brick-Set Tubular Heater
Shell Unit Heater
Write now for more information

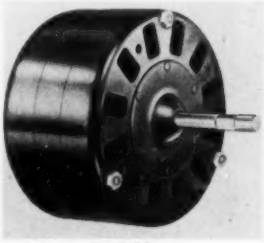
LEE ENGINEERING CO.
95 RIVER ST. HOBOKEN, N. J.


### Fractional Horsepower Motors

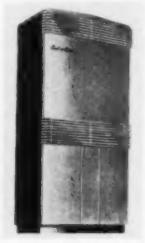
HPAC 18—Two new motors have been added to the line of six pole, shaded pole fractional horsepower motors produced by Fasco Industries, Inc., Rochester, New York.

One, the "Space-Saver" model, now available in 1/15, 1/20, 1/25, and 1/30 hp, features a 15/16 in. stack. The standard 5 in. diameter is retained in this model which is recommended for window fan installations.

The second new motor is a reversible model, available in all of the company's standard six pole horsepowers, 1/30 through 1/8. This motor is said to be ideal for use in double-duty fan-or-exhaust window fans.



Small Motor



Air Conditioner

### Room Coolers, Packaged Conditioners

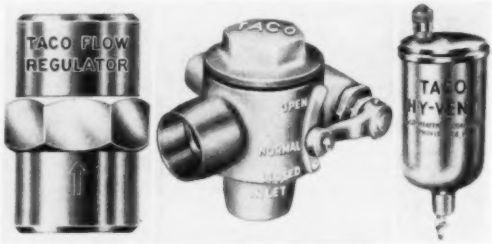
HPAC 19*—The "Cool-a-Matic" line of air conditioning products of Automatic Firing Corp., 4417 Oleatha, St. Louis, includes a window type room unit available in ½ and ¾ ton capacities and a packaged air conditioning unit offered in 3, 5, and 7-½ ton capacities.

Less than a year ago the company purchased the equipment and plant of General Engineering and Mfg. Co. Taking several of the features of the "Gemco" packaged conditioner, the firm has developed a basically new product incorporating a new compressor system, a new condenser unit and other refinements.

In addition to developing a window type unit, Automatic Firing has introduced the "Fridg-a-Fire", a twin unit heater-cooler furnace that cools by refrigerated air in summer and provides gas heat in winter.

### Flow Regulator, Valve, and Air Vent

HPAC 20—Shown in the accompanying illustration are, from left to right, the new flow regulator, flow valve, and automatic hot water air valve of Taco Heaters, Inc., 137 South St., Providence 3, R. I.




Of brass and rubber construction with two internal pipe threads, the flow regulator is designed to control the flow of water through tankless heaters, etc., at any pressure from 15 to 150 psi. Capacities range from 3 to 8 gpm.

# VENTILATE with a *Brundage* BLOWER EXHAUSTER

- AIR CONDITIONING
- INDUSTRIAL VENTILATION
- FUME AND SMOKE REMOVAL

- ✓ HIGHER STATIC PRESSURE
- ✓ EXTREMELY VERSATILE
- ✓ FASTER AIR REMOVAL
- ✓ QUIET OPERATION

Get the ultimate in industrial ventilation with a dependable Brundage Blower Exhauster. Brundage Exhausters are available in eleven sizes covering a complete range of performance requirements. Adaptable to any angle of discharge, the Exhauster can be used for air conditioning and smoke and fume removal. Precision built, yet economically priced, Brundage Exhauster units insure complete satisfaction. For your next ventilation job specify a Brundage Blower Exhauster unit.

**Brundage COMPANY**

*Blower Specialists Since 1919*

541 NORTH PARK STREET
KALAMAZOO 11, MICHIGAN

**EXTRA FAST, EASY**

*Pipe Reaming*

**ON 1/8" TO 3" PIPE**

**And RIDGID LonGrip Reamers Won't Flare or Split Pipe**

● It's the extra-long-taper on RIDGID LonGrip reamer that makes it smooth the burr cleanly out of pipe or conduit almost without effort. Just a few light ratcheted strokes and your job's done—no worry about thinning, flaring or splitting. Saves your time, work and *pipe*. Furnished complete with ratchet handle, or No. 2 reamer unit sold separately for use in RIDGID OOR small ratchet die handle. Two sizes, No. 2, ⅛" to 2"; No. 3, ⅛" to 3". Ask your Supply House.

RIDGID
WORK-SAVER PIPE TOOLS

THE RIDGE TOOL CO. • ELYRIA, OHIO

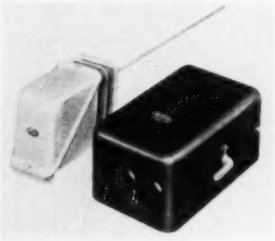

The flow valve is of all-bronze construction and incorporates a machined weight and seat, a bronze spring cushion, and a three position (open, closed and normal) adjustment. It is available only in the 1 in. size and is designed to prevent hot boiler water from flowing to a heating system when the circulator is not running.

The hot water air valve is designed for automatic venting of air from panel heating systems, high points, and downfeed heating systems, as well as cold water lines. Features are said to include high venting capacity, the use of noncorrosive materials, and float type construction.

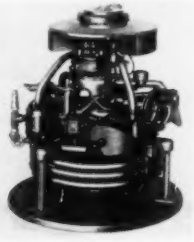
### Combustion Safeguard for Gas Burners

HPAC 21—Combustion Control Corp., 77 Broadway, Cambridge 42, Mass., has developed a new "Fireye" system for providing flame failure protection and programming for industrial and commercial automatic gas burners. The equipment includes programming control type 24PJ8 and electronic flame rod type 45JQ1.

The control programs the sequence of purging the blower motor and ignition fuel valve opening, and post ignition timing. The fuel valve delay and post ignition periods can be set upon installation, and a calibrated dial indicates the timing adjustment in seconds. The flame rod prevents the main gas valve from opening until the pilot flame is established and detected. Once the flame is established, the rod "feels" the presence of the flame, and if the flame fails, signals the control which cuts off fuel. The control can be wired to operate an alarm upon flame failure.



Gas Burner Control



Air Compressor

### Air Compressor

HPAC 22—A new 36 cfm "Spot-Air" compressor has been introduced by Ingersoll-Rand Co., 11 Broadway, New York 4. It weighs 265 lb and stands 32 in. high on a 27 in. diameter base plate. A special wheelbarrow mounting enables one man to take the unit and its air tools "almost anywhere".

A horizontal arrangement of three power cylinders and three air cylinders spaced alternately at 60 deg intervals around a vertical single-throw crankshaft is said to provide smooth conversion of engine power into air power without the need of a heavy flywheel. The four-cycle gasoline engine is equipped with overhead alloy steel valves with adjustable tappets. Exhaust valves, with "Stellite" seat inserts, are of the "free type" which allow rotation for a longer valve life. The fuel tank capacity permits 2 to 2½ hr. continuous operation. The unit delivers 36 cfm at 80 psi, and is said to be ideal for operating the company's J-10 utility "Jackhamer" or many other small air tools.

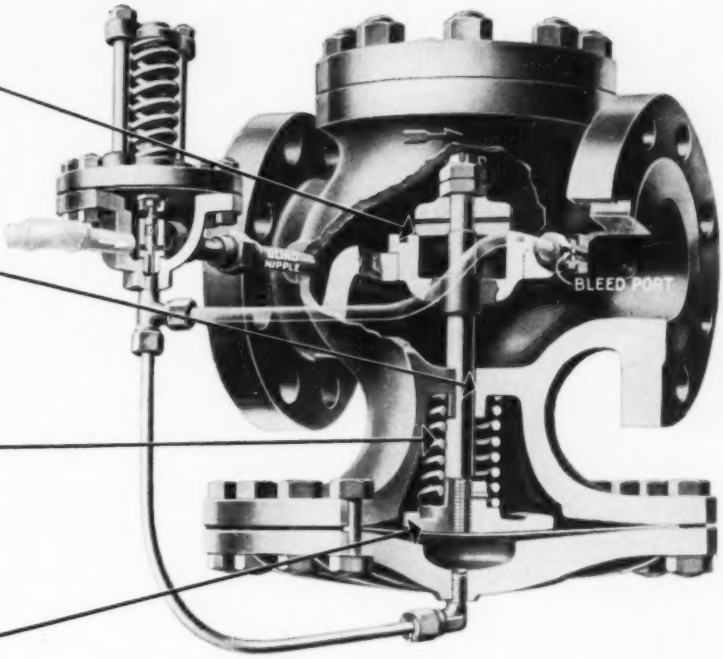
# WHY Spence Regulators Outlast The Field

**SECO METAL SEATS AND DISCS** — Durable SECO Metal resists wiredrawing. More than *twenty years of experience* in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

**PACKLESS CONSTRUCTION** — All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . eliminates much time-consuming maintenance.

**SPRING OUT OF PATH OF STEAM** — The spring in the Spence Regulator is out of the path of the steam or other fluid flowing through the valve. It operates at low unit stress for exceptionally long life.

**LARGE BALANCED DIAPHRAGM**—Spence metal diaphragms, under usual conditions, never require replacement. Spence Regulators have few moving parts and those few are ruggedly constructed and seldom require attention.




Spence Type EQ back pressure regulator — operation of main valve is controlled by a sensitive pilot to regulate the initial pressure. Same pilot is used with all sizes of main valves.

The features shown above explain why you profit on every important count with Spence Pressure and Temperature Regulators.

Learn more about these and many other advantages of Spence Regulators by sending for Bulletin 350.

**DURABILITY** — Spence Regulators perform dependably year after year.

**ACCURACY** — You can be sure of accurate control for the life of the regulator.

**MAINTENANCE** — You don't need expensive repairs or special maintenance. That means less down-time, less time and money wasted on replacement of parts.

SE-110

**SPENCE ENGINEERING COMPANY, INC.**
**WALDEN, NEW YORK**

Spence

"The Chemistry of Construction" calls for

DRAIN LINE PERMANENCE

DURIRON ACID PROOF DRAIN PIPE

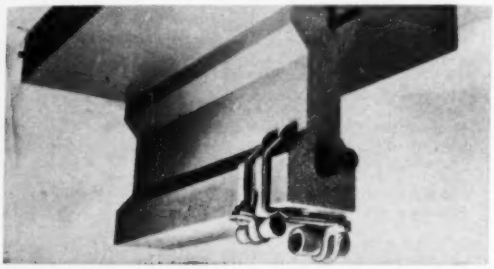
A card or letter will bring you free Bulletin Number 703A completely describing DURIRON Acid-proof DRAIN PIPE.

Specifications, like chemical formulae, call for certain elements of construction to produce desirable qualities in a building. Chemical laboratories, in industry, schools and hospitals, carefully consider *drain line permanence* for handling corrosives. DURIRON Acid-proof DRAIN PIPE enjoys a preference for three reasons: (1) Duriron itself is highly resistant to practically all corrosives, (2) the entire thickness of the pipe wall is Duriron and, therefore, corrosion resistant, and (3) Duriron is virtually unaffected by abrasives.

THE DURIRON COMPANY, Inc., Dayton 1, Ohio
*Branch Offices in Principal Cities*

### Hangers for Piping, Ducts, Conduit

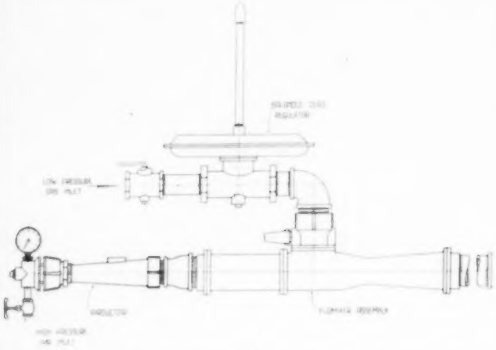
HPAC 23**—The "Loadgrip" clamp hanger of United Industries, Box 449, Madison 1, Wis., has been developed for attaching piping, conduit, ducts, furring strips, and other suspended fixtures to the underside of precast concrete joists. It consists of a two piece hanger that can be assembled and installed on a standard precast concrete joist without the use of special tools.



Pipes or ducts may be hung from joists in either longitudinal or transverse directions and are attached to the hangers by means of supports bolted through one or more of the three untapped holes provided in the horizontal legs of the hanger. According to the company, strap supports for large pipes can be used with equal facility, and ducts can be suspended between or below the joists, using standard fittings.

### Provides Low Pressure Air

HPAC 24—The new "Air-Ductor" is a device for producing large volumes of low pressure air (up to 1 psi) using compressed air at 30 to 150 psi as a power source. The device is recommended for use where low pressure air usage is infrequent and purchase of a blower would not be justified. The manufacturer is Bryant Industrial Div., Affiliated Gas Equipment, Inc., 17825 St. Clair Ave., Cleveland 10.



High pressure air consumption is said to average 25 to 35 percent of the volume of 16 oz pressure air produced and will decrease with lower delivery pressures and higher compressed air pressures. The venturi type unit is supplied with the outlet connection sized to minimize pressure losses. The assembly includes high pressure needle valves and pressure gages. In the illustration, the unit is arranged to provide combustion air for burning gas.

# DISCHARGED FROM ACTIVE DUTY

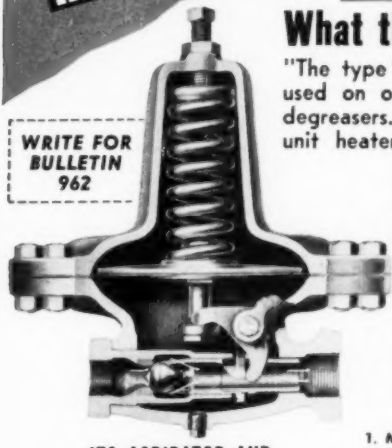
When the '1000' VALVE Goes on the Job . . . . These Troublemakers are THROUGH . . .

**CASH STANDARD** *Streamlined* PRESSURE **REDUCING VALVE** TYPE 1000

## What this user says IS PROOF:

"The type '1000' valves we have in our plant are used on our heating system and washers and degreasers. Our heating system is almost entirely unit heaters and with varying conditions, the valves are called on to operate at both small capacities and wide open. When the wind is mild the valves are practically dead ended and when the weather is cold, the valves are called on to open and close very rapidly. On our washers and degreasers we don't have anything else but the Cash type '1000.' Our oldest valves in the plant are seven years old, but they are working perfectly."

WRITE FOR BULLETIN 962



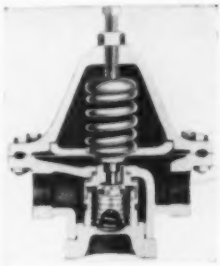
ITS ASPIRATOR AND STREAMLINED FLOW WORK TO YOUR BENEFIT IN THESE 12 WAYS . . .

1. Maximum Capacity when needed most. 2. Accurate Pressure Control under toughest working conditions. 3. Trouble-free Service. 4. Smooth Operation. 5. Tight Closure. 6. Accurate Regulation. 7. Speedier Production Results. 8. Elimination of Failures. 9. Constant Delivery Pressure. 10. Cost Saving Operation. 11. No Spoilage. 12. Practically zero in maintenance costs.

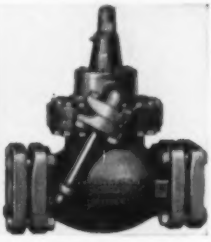
**CASH STANDARD CONTROLS . . . VALVES**

**A. W. CASH COMPANY**
DECATUR, ILLINOIS

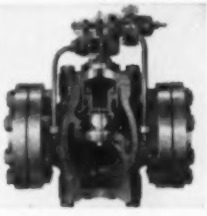
**BULLETINS AVAILABLE ON OTHER CASH STANDARD VALVES**
*Send for them*



Bulletin 950—features the CASH STANDARD Type D Single Seat Pressure Reducing and Regulating Valves for use with most fluids. Shows simple inner working parts that save in maintenance. Diagram explains how valve works. Blueprint shows simplicity of installation.



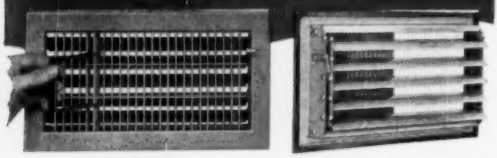
Bulletin 956—features the CASH STANDARD Type 4030 Back Pressure Valve — designed to automatically maintain a constant pressure in the evaporator corresponding to a constant temperature desired. Shows an Ammonia and Freon Gas Capacity Chart based on ABSOLUTE pressures.



Bulletin 966—features the CASH STANDARD Self-Contained, Pilot Operated Type 10 Pressure Reducing and Regulating Valve for use with water or air; with any gas or oil that is non-corrosive; and with refrigerating fluids such as Ammonia and Freon. Many interesting particulars explained such as: how valve works, tight seating, large capacity, no waste, no water hammer or chatter.

You can get
DIRECTED AIR FLOW
at any angle with

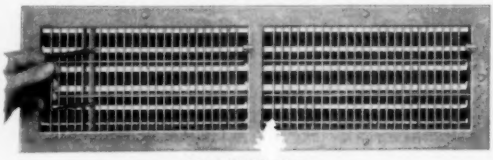
INDEPENDENT
"Fabrikated"
AIR CONDITIONING
REGISTERS



321-A HMV

Rear View Showing "HMV" Valves

Every grille bar adjustable individually—before or after installation



321-A HMV Tandem

Any direction of air flow—right, left, up, down and any combination—is easily obtained with "Fabrikated" Style No. 321-A HMV air conditioning registers, for residence or commercial installations, on sidewalls or ceiling. The face bars are adjustable to right or left; valves on the back are adjustable to direct the air flow up or down; valves may also be fully closed, and are connected to open or close in unison.

The angles of deflection and the combinations to be had are practically unlimited. Adjustments for directed air flow may be made before or after installation. Grille bars are held firmly in place and will not vibrate or rattle.

"Fabrikated" registers are available in sizes from 8 x 4″ to 48 x 24″, including tandem style. Special sizes can be made without special die set-up charges.

Write for Catalog No. 50.

*Always Leading—Always Progressing*

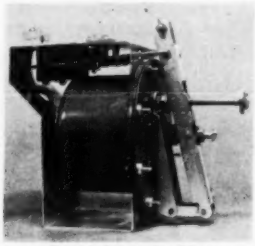
THE INDEPENDENT REGISTER CO.
3747 E. 93rd STREET • CLEVELAND, OHIO

### Motor with Preset Speed

HPAC 25—The ACA motor (a-c adjustable speed) is now available with a mechanical follow-up control for achieving a fixed preset speed without the use of expensive control equipment, according to the small and medium motor divisions of General Electric Co., Schenectady 5, N. Y.

The new device enables a predetermined speed to be set manually by a knob either directly on the motor or at the end of a flexible cable 10 or 15 ft away. The speed adjustment can be made while the motor is at a standstill or while it is running. Speed control is obtained by rotating brushes around the commutator. In operation, the new mechanism actuates a pilot motor which drives the brushes to a position corresponding to the setting of the speed adjustment knob. A stop or automatic slow-down returns the brushes to the lowest speed position without disturbing the original setting. When the motor is restarted, the brushes again come back to the preselected speed without any attention from the operator. Accelerating time is dependent upon pilot motor speed.

Variable Speed Motor



Control System Air Motor

### Temperature Control For Trolley Coaches

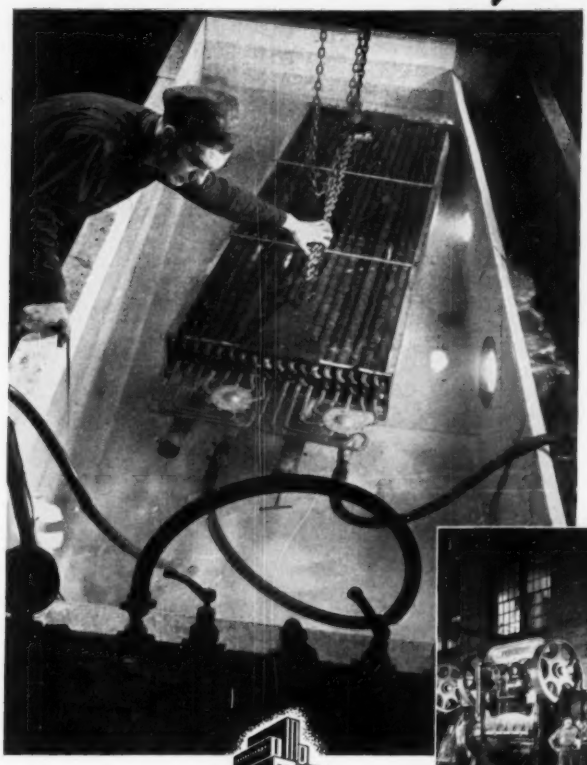
HPAC 26—A new automatic temperature controlling system for trolley coaches has been developed by Minneapolis-Honeywell Regulator Co., 2604 Fourth Ave., S., Minneapolis 8.

The units of the system, which have been specially adapted for trolley coaches, are the same as those employed for the company's bus controls. The system operates on a modulating principle and employs a single pneumatic thermostat operating an air motor connected to a waste heat damper. An end switch is mounted on the motor and turns on auxiliary heat whenever the damper is fully opened. In operation, the thermostat automatically positions the damper to permit a constant flow of heat into the coach at any selected temperature. The heat, created by electrical resistance, which is not needed in the coach is directed to the outside. When all waste heat delivered into the coach is insufficient to maintain selected temperatures, the end switch automatically turns on auxiliary heaters. Shown in the illustration is the air motor which is operated by the pneumatic thermostat and is connected to the waste heat damper.

### Suspended, Oil Fired Heaters

HPAC 27—"Shafconaire" overhead heaters, formerly known as "Shafco", now feature a new improved casing assembly said to facilitate handling and installation operations. The manufacturer is Overhead Heaters, Inc., 1354 Book Bldg., Detroit 26.

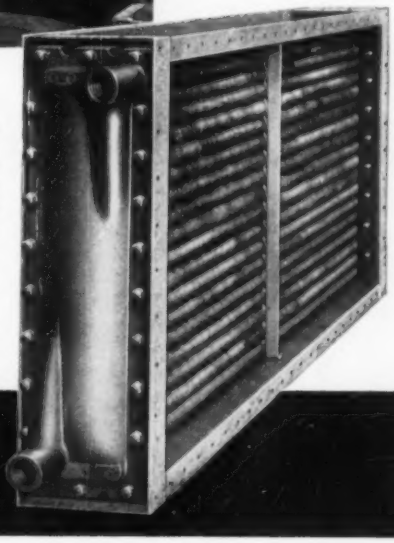
# *Here's the Story* ON AEROFIN...



This man is completing one of the many tests used to control the quality of Aerofin finned heat-transfer surface. He is looking for air bubbles in a specially illuminated tank. If there are no bubbles, it means the immersed Aerofin unit has withstood the terrific strains of steam and hydrostatic pressure tests and is ready to give you long, efficient service.

Such rigid specifications and inspection, backed up with over 25 years of experience in manufacturing finned heat-transfer surface, assures you of Aerofin dependability, durability and maximum efficiency.

Aerofin is devoted exclusively to the production of finned heat-transfer surface. This specialization enables Aerofin engineers to select just the right surface and materials for the job, enables expert workmen to assemble these materials into a highly efficient unit.



The end result of Aerofin research, engineering and specialized production is the Aerofin Finned Heat-Transfer Unit. Day after day, thousands of units like this one demonstrate their superiority under the most severe conditions. Complete research and accurate ratings allow you to install Aerofin at full rating with confidence. You can depend on Aerofin to give you long, efficient service.

*Throughout the Air Conditioning Industry—*

**Aerofin units do the job Better, Faster, Cheaper**

AEROFIN CORPORATION

410 South Geddes St., Syracuse 1, N. Y.

NEW YORK CHICAGO CLEVELAND DETROIT
PHILADELPHIA DALLAS MONTREAL

Designed for use with oil, this direct fired air heater now features a casing designed to incorporate built-in frame support members as well as six external welded suspension brackets predrilled for ⅝ in. rods and located on the heater base to support the weight of the furnace without strains or stresses.

Basic engineering features have not been changed. These include a built-in plenum chamber, the use of welded boiler plate furnace construction, an intermediate heat travel section between the refractory lined firebox and the heat exchangers, and the use of baffle plates in each heat exchanger section to retard the flow of hot gases and to permit maximum transfer of heat through the exchanger.

### Portable Spot Welder

HPAC 28—A new portable spot welder known as "Zip" has been introduced by Mid-States Welder Mfg. Co., 6025 S. Ashland Ave., Chicago 36. Features such as fixed top tongs and newly designed adjustable curved tips are said to afford ease of handling and operation. Assorted tong lengths and shapes are available for specific welding applications.

Weighing 23 lb, the unit is portable and is designed to weld mild steel, stainless steel, galvanized iron, terne plate, and magnesium up to ⅛ in. combined thickness of metal. Models are available for either 110 volt or 200 volt a-c current.

### We Hear That

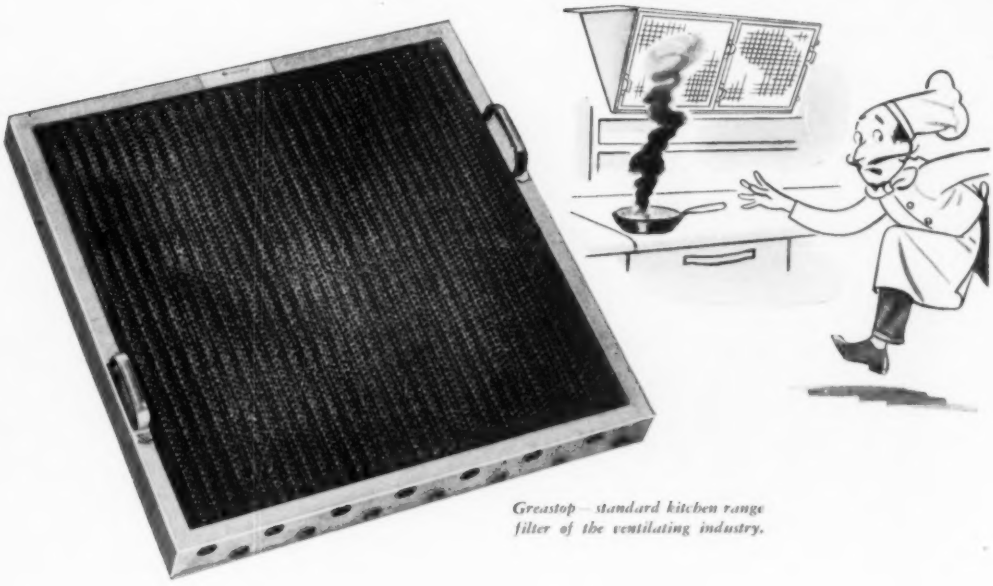
In an effort to prevent the growth of a new gray market, *SPANG-CHALFANT DIV., NATIONAL SUPPLY CO.*, Pittsburgh, has introduced a plan whereby its standard pipe jobbers are asked to "direct all tonnage received into proper channels fairly and equitably and report promptly any instance of diversion into improper channels so that corrective measures may be applied immediately." Consumers of tubular products are asked not to order beyond their current requirements, nor to offer the product for resale. They, too, are asked to report any instance of diversion of products into improper channels.

The organization of a mechanical dehumidifier section of the *REFRIGERATION EQUIPMENT MANUFACTURERS ASSOCIATION* has been completed. The aim and purpose of the section is to form a common meeting ground for consideration of standards, statistics, publicity, research, and promotional activity on mechanical dehumidifiers. Permanent officers will be elected at the next meeting scheduled for February in Washington, D. C.

*YOUNGSTOWN SHEET AND TUBE CO.*, Youngstown, Ohio, held golden anniversary open houses last month at a number of plants. Inspection trips marked the 50th anniversary of the company which was organized by a small group of eastern Ohio business leaders and which has grown to one of the nation's major steel producers, capitalized at more than $250,000,000 and employing more than 26,000 persons.

A reorganizaion of its distribution sales responsibilities in the field has been effected by the air conditioning dept.

# Commercial kitchens use more Greastops* than any other exhaust duct filters!



*Greastop — standard kitchen range filter of the ventilating industry.*

IN HOTEL, restaurant and cafeteria kitchens everywhere, the first choice for kitchen exhaust duct filters is Air-Maze Greastop filters. Their outstanding performance during the past twenty years has proved Greastop's sound design and high efficiency to owners, engineers and contractors alike.

Greastop filters are *engineered* to give greater grease-holding capacity and longer periods between servicing. Greastop's progressive density effectively removes lint and bulky grease particles without restricting the air flow. A special nickel-zinc plated steel screen cloth effectively resists corrosion caused by fatty acids.

Greastop filters are available in wall angle or V-type assemblies as well as individual panels and holding frames. For further information contact your nearby Air-Maze representative, or write the Air-Maze Corporation, 5200 Harvard Avenue, Cleveland 5, Ohio.

**OTHER AIR-MAZE CLEANABLE AIR FILTERS**

*Electro-Maze electrostatic precipitator filters*

*Type-B Heavy-duty industrial panel filters*

*Type-P-5 high velocity panel filters*

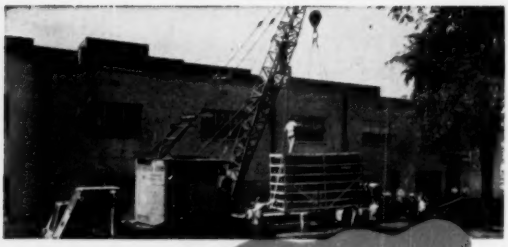
*Kleenflo for standard ventilating applications*

*Trade-mark Reg. U. S. Pat. Off.

**AIR FILTERS**
**SILENCERS**
**SPARK ARRESTERS**

**AIR-MAZE**
**THE FILTER ENGINEERS**

**LIQUID FILTERS**
**OIL SEPARATORS**
**GREASE FILTERS**



PAT. NO. 2,297,928

Save water! Save space! Save installation time and money! Save operating costs! Yes, install Governair and *save from $50 to $200 for each ton* of the completely packaged Governair unit designed to fit your needs!

Experience proves Governair can save you up to $5,000 on a 50-ton Governair unit that gives greater dependability and more "engineered efficiency" than ever before!

If you want the best — if you want the most economical and reliable air-conditioning unit on the market . . . CHOOSE GOVERNAIR and SAVE!

AIR CONDITIONERS

EVAPORATIVE CONDENSERS

BLAST COILS FOR HEATING & COOLING

ORIGINATORS OF COMPLETELY PACKAGED AIR CONDITIONERS

GOVERNAIR

UNIT COOLERS

GOVERNAIR CORPORATION · 513 N. BLACKWELDER · OKLA. CITY

of *GENERAL ELECTRIC CO.*, Bloomfield, N. J. Under this revised plan, the country is divided into four regions each of which is to be headed by a regional manager who will oversee all sales operations to franchised distributors. *H. J. WINES*, manager of distribution sales, will administer the new setup from department headquarters.

This GE arrangement will apply to automatic heating products, packaged air conditioners, and central plant air conditioning installations of less than 50 tons. All air conditioning installations over 50 tons will be treated as a direct sale and will be administered by *J. D. HOFFMAN*, manager of direct sales. Direct sales representatives of the department will report directly to headquarters at Bloomfield.

A typical pressure loss testing hook-up, the counterpart of actual equipment used in its valve design, will be a feature of the exhibit of *EDWARD VALVES, INC.*, East Chicago, Ind., at the 1950 Power Show which opens this month at Grand Central Palace, New York City. The test arrangement will demonstrate, using half section models of both conventional valve body styles and the company's new streamlined bodies, comparative flow characteristics. The opening action and pressure drop characteristics of the company's piston-type check and stop-check designs will be demonstrated.

Several hundred prominent scientists, educators, industrialists, and Army, Navy and governmental officials attended the recent ceremony marking the laying of the cornerstone for the new research laboratories of *ARMSTRONG CORK CO.*, Lancaster, Pa. *DR. VANNEVAR BUSH*, president of Carnegie Institution and wartime head of the Office of Scientific Research and Development, presented the main address. The laboratories are expected to be completed by the middle of next year.

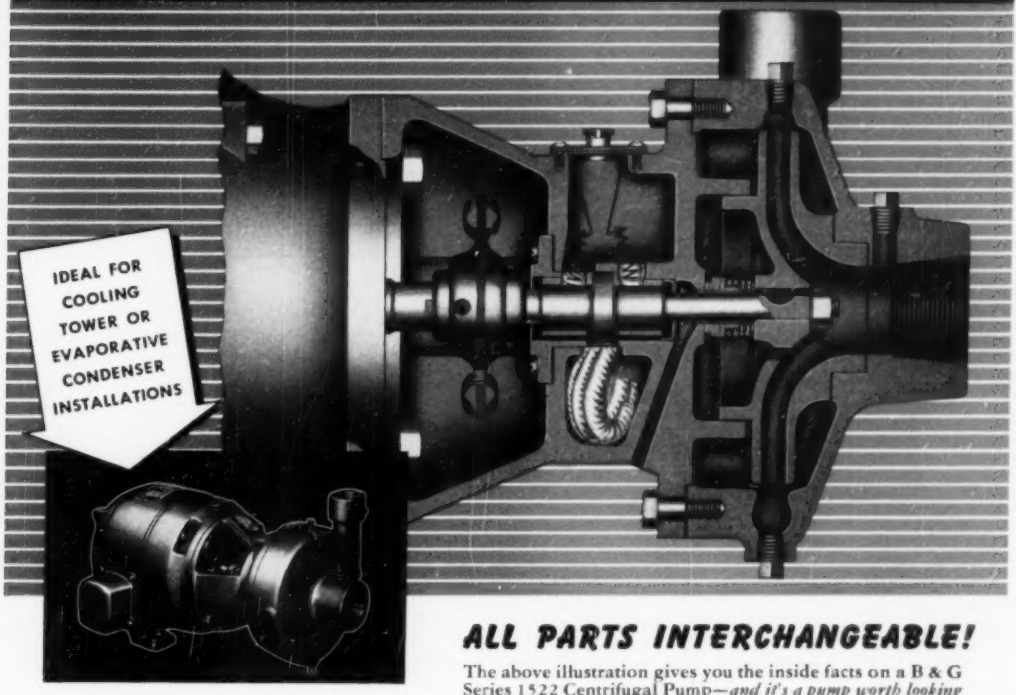
By the end of the year, *MODINE MFG. CO.*, Racine, Wis., will have sold more than 24,000 individual steam heating convectors for apartments in New York and New Jersey. The firm is also supplying hot water heating units for another project in New Jersey, designed to accommodate 4000 individual apartments. Individual temperature control by tenants in these multi-family units will be accomplished. The steam convectors will be used on one pipe systems.

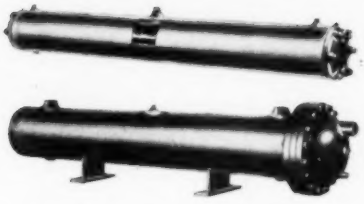
*SANTA FE TANK & TOWER CO.*, Los Angeles, has initiated a series of nationwide engineering forums to acquaint virtually all phases of industry with cooling tower design, construction, and maintenance. The first forum was conducted in Denver by DR. N. W. SNYDER, consulting engineer for the company. Another has been held in Los Angeles and others are scheduled for San Francisco, Tulsa, Houston, Dallas, El Paso, Phoenix, and Chicago.

*ROY O. NELSON*, formerly sales manager of C. H. Bevington Co., has formed his own manufacturers' representative firm known as ROY O. NELSON CO., 330 S. Wells St., Chicago 6. Because of the recent death of Mr. Bevington, his organization has been dissolved. The new firm will represent Vulcan Radiator Co., Skidmore Corp., Davidson Fan Co., and Overhead Heaters Inc.

# B & G 1522 *Challenges Comparison*

## ...WHERE ELSE CAN YOU FIND SO MANY PERFORMANCE FEATURES IN ONE PUMP!



**B & G REFRIGERATION EQUIPMENT**

B & G precision-built Evaporators, Condensers, Liquid Receivers and Heat Exchangers offer performance-proved design — rugged, long-lived construction—painstaking workmanship. Send for engineering data.

### *ALL PARTS INTERCHANGEABLE!*

The above illustration gives you the inside facts on a B & G Series 1522 Centrifugal Pump—*and it's a pump worth looking into!*

Viewing from left to right, note the *exclusive* spring-type Coupler—keeps noise at a minimum. Next, the Shaft—polished special alloy steel of finest quality, with electronically hardened thrust collar. It rotates in long Bronze Bearings which assure alignment and smooth operation. Oil from the reservoir is brought to the bearings by the wicking—keeps them thoroughly lubricated.

Now the Mechanical Seal—self lubricating—positively excludes water—ends annoying leakage. And finally, the Impeller—hydraulically balanced and highly efficient throughout the entire capacity range.

All parts are interchangeable in B&G Series 1522 Pumps. By removing a few bolts, the pump separates into three parts—very easy to service if ever necessary.

The B & G 1522 is really a pump you can lean on! For complete information, send for Catalog CY-350.

B & G

## *Hydro-Flo* REFRIGERATION EQUIPMENT

**BELL & GOSSETT COMPANY**

**Dept. RBU-5, Morton Grove, Illinois**

*Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Road, Toronto, Canada*

•Reg. U. S. Pat. Off.

# Only AGITAIR®

## SQUARE & RECTANGULAR AIR DIFFUSERS

Give you these

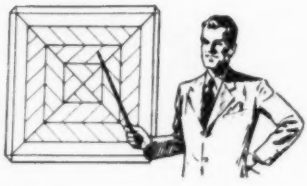
**Two** Important Features

---

**1**

### PATENTED BUILT-IN DIFFUSING VANES

*Agitair diffusing vanes really mix the air, insuring rapid diffusion and temperature equalization. This permits the use of higher temperature differentials. It also makes possible the introduction of larger "cfm" quantities which can be limited to shorter "blows."*



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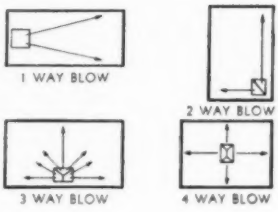
**2**

### TAILOR-MADE FOR 1, 2, 3, AND 4 WAY BLOWS

*Agitair square and rectangular diffusers come in a variety of patterns to provide blows in one-two-three- and four directions. Thus 100% air distribution is assured in any shape area, from any location without blank-off's or oversized outlets.*

*Write for Complete Data*

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**AIR DEVICES Inc.** 17 EAST 42nd ST. • NEW YORK 17, N. Y.

AIR DIFFUSERS • AIR FILTERS • ROOF EXHAUSTERS

*WAGNER ELECTRIC CO.*, St. Louis, and its more than 7000 employees held a two-day open house last month which was attended by 15,000 persons who became acquainted with the company's products, its modern production equipment, and its contribution to the welfare of the community and the country. A special exhibit of products and a tour of the plant were highlights.

A controlling stock interest in the *COMMONWEALTH ELECTRIC CO., LTD.*, Welland, Ontario, Canada, has been purchased by *RELIANCE ELECTRIC & ENGINEERING CO.*, Cleveland. The manufacture of transformers and electric motors, both Commonwealth products, will be maintained in the Welland plant, where currently about 200 men are employed.

In addition it is proposed to expand operations to permit the production of Reliance variable speed drives and a number of other specialized electric drives, regularly supplied by Reliance. The presidency of Commonwealth, which has been open since the death of *RUSSELL STINSON*, will be filled by *J. W. COREY*, who also continues as president of Reliance.

Offices of *MANNION & McCANN*, Chicago representative of *THE TRANE CO.*, La Crosse, Wis., have been moved from 2326 S. Michigan to 341 E. Ohio St., Chicago. . . . . *ECLIPSE FUEL ENGINEERING CO.*, Rockford, Ill., expects to complete a new main factory and office building early next year. The new building will increase manufacturing area by over 200 percent and will include air conditioning in a large part of the factory and offices.

*HOWELL ELECTRIC MOTORS CO.*, Howell, Mich., has appointed *BATES SALES CO.*, 1025 N. Sixth St., St. Louis, Mo., factory sales and service representative in that area. The St. Louis firm is under the direction of *HOWARD D. HEBEBRAND*, owner. . . . . The Chicago office of *D. J. MURRAY MFG. CO.*, Wausau, Wis., is now located at 612 N. Michigan Ave., and *O. J. MALINA*, sales manager of the unit heater division, is in charge.

*CAPEWELL MFG. CO.*, Hartford, Conn., producer of hack and band saws, hammers, special nails, etc., has extended its line of products by the acquisition of *V-MAC INDUSTRIES, INC.*, Guilford, Conn., manufacturer of pipe threading, cutting and reaming tools. All machinery and production facilities of V-Mac and all of its employees are being retained and have been moved from Guilford to Hartford.

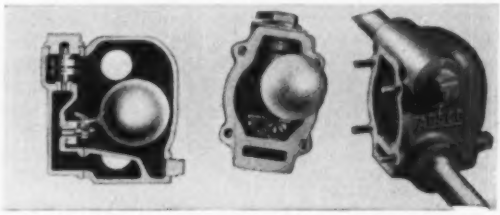
Distribution of the pipe tools will be through the existing Capewell sales organization of direct representatives, sales agents, and distributors. *WAYNARD VOSPER*, formerly president of V-Mac, will supervise production. Other pipe tools are now being developed and will be added to the line.

A recent innovation for heating controls of *PERFEX CORP.*, Milwaukee, is a new "Warmer-cooler" temperature dial which is now available on the firms' "Magic Dial" thermostats. According to the manufacturer, field tests indicate that the warmer and cooler markings on the dial help to cut down on troublesome service calls resulting from dial settings disagreeing with thermometer readings.

**how to get maximum dependability with minimum maintenance**

**DUAL STEAM TRAPS**

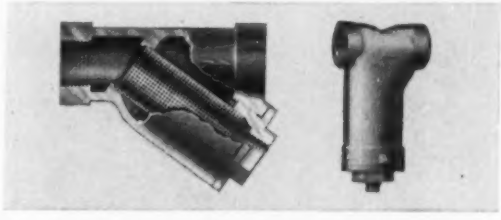
*Dual Connections — Dual Valve and Seat*



ADSCO's special design and construction features provide dependable, efficient operation, longer service life, and economy in installation and maintenance. Inlet and outlet connections on both sides of the body. Reversible stainless steel valve and seat double the life of the wearing parts. All working parts are mounted on the cover which can be removed without breaking pipe connections. Spare covers with valve assemblies can be installed in minutes with a minimum interruption of service. Full range of sizes. For all pressures to 125 psi. *Write for Bulletin No. H-35-87.*

**"Y" AND "T" STRAINERS**

*Protect expensive equipment by preventing clogging*



It's good practice to install a strainer ahead of every trap—as well as every regulator, pump or valve. Reduces maintenance and prevents costly shut-downs. ADSCO Y- and Y-Type Strainers are expertly designed to remove dirt, scale and other foreign matter from steam, gas, air, water and oil lines. Wide range of sizes. *Write for Bulletin No. H-46-50A.*

Expansion Joints
Steam Traps · Meters
Anchors · Guides

ADSCO
Since 1877

Heat Exchangers
Strainers · Separators
Casing · Supports

**AMERICAN DISTRICT STEAM COMPANY, INC.** · North Tonawanda, N.Y.

# WHO'S WHAT

*CHASE BRASS & COPPER CO. INC.*, Waterbury, Conn., has elected President *ROBERT L. COE* chairman of the board and has elected *RICHARD C. DIEHL*, former general manager of the Steubenville, Ohio, plants of Wheeling Steel Corp., president. Mr. Coe began his business career with Chase in 1917 and, after several years in the mills, joined the sales force, later becoming vice president in charge of sales. He became president in January of this year. Mr. Diehl has spent his entire career in the steel industry and has been associated with Wheeling for 15 years.

*EDMUND P. LUNKEN*, vice president, *LUNKENHEIMER CO.*, Cincinnati, has also been elected secretary. He succeeds *CHARLES W. BURRAGE*, now manager of sales engineering, who resigned to devote full time to sales . . . . . *JAMES C. PEEBLES*, dean emeritus of engineering at Illinois Institute of Technology, has been appointed chief of the *ILLINOIS COMMERCE COMMISSION*. . . . . The new executive vice president of *W. B. CONNOR ENGINEERING CORP.*, New York City, is *W. V. DAVIDSON, JR.*

*S. S. INCH*, general sales manager, *KAISER ALUMINUM & CHEMICAL SALES, INC.*, Oakland, Calif., has been named vice president in charge of sales. *THOMAS J. READY, JR.*, assistant general manager of *KAISER ALUMINUM & CHEMICAL CORP.*, is now a vice president and *RUSSELL A. CLAYTON* is controller of the same organization. *DONALD E. BROWNE*, formerly controller, is vice president and treasurer. All four men have been connected with Kaiser Aluminum in administrative capacities since the company entered the industry.

*JOHN A. P. OHMAN*, a specialist in the building of industrial process instruments, has been appointed a senior research engineer in the physics department of *SOUTHWEST RESEARCH INSTITUTE*, San Antonio, Tex. He is a former vice president of Geovision, Inc., of New York City, and was chief engineer for Rieber Research Laboratory of the same city. . . . . *ELLIOTT V. BELL*, chairman of the executive committee, McGraw-Hill Publishing Co., Inc., has been elected to the board of directors of *CARRIER CORP.*, Syracuse, N. Y. He is also editor and publisher of Business Week and was formerly superintendent of banks of the state of New York.

*CHARLES A. NEIMAN*, chief engineer, and *JOHN KEARNS*, general works manager, have been elected vice presidents in charge of engineering and production, respectively, of *YORK-SHIPLEY, INC.*, York, Pa. *DEAN D. BARBOR*, formerly secretary and assistant treasurer, has been named secretary-treasurer and *E. A. SCHAEFER* is now assistant secretary. Mr. Neiman joined the company in 1942 and has been chief engineer since 1946. Mr. Kearns has also been with the company since 1942, becoming production manager in 1945 and general works manager in 1949. Mr. Barbor joined the firm in 1944, in charge of the accounting department.


Sell Them CLEANER AIR and MORE OF IT

with DWYER VISI-FLOAT AIR FILTER GAGE

for
WARM AIR FURNACES
UNIT AIR CONDITIONERS
AIR CONDITIONING SYSTEMS

First gage of its type for permanent mounting on forced air units. Low-cost . . . foolproof . . . self-operating. Tells at a glance from face of heater, air-conditioner, or ventilator when filters are clogged and need replacement. No liquids, no mechanical parts to break down. VISI-FLOAT comes ready to use. A clear, lifetime, lucite body with a floating indicator. Connected across filter, and reacts constantly to varying pressure drop due to dirt accumulation. Lasts the life of the unit. Just drill two holes and mount. Let VISI-FLOAT cut fuel bills, allow more and cleaner air flow, reduce blower failure and repairs.

ONLY $3.25

VISI-FLOAT Models are available for all types of DOMESTIC, COMMERCIAL AND INDUSTRIAL APPLICATIONS.

Write Today for Bulletin No. 280 for Full Details

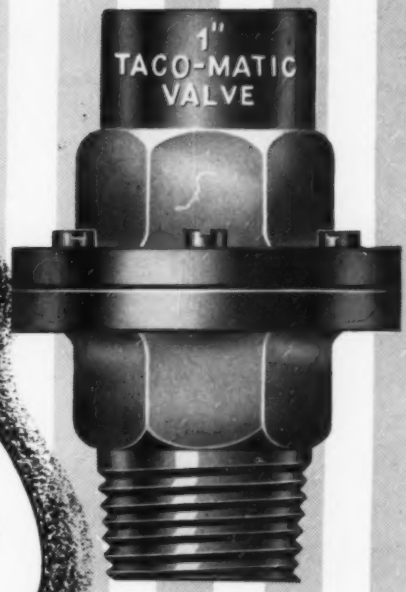
F. W. Dwyer Mfg. Co.

323 South Western Avenue • Chicago 12, Illinois

IT'S NEW
...SMALLER IN SIZE
...LOWER IN PRICE

# IT'S THE NEW 1" TACO-MATIC VALVE

MORE AND MORE FOLKS WHO'VE TRIED THE 1¼" and 1½" SIZES ASKED US FOR THIS SMALLER SIZE

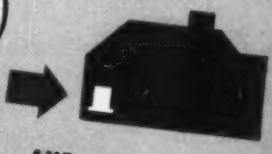



**PROTECTS TANKLESS HEATER PERFORMANCE BY SHUTTING OFF WHEN BOILER WATER TEMPERATURE DROPS TO 175 F.**

TACO-MATIC shuts off tight when boiler water drops below 175 F., enabling the low limit control and burner to maintain satisfactory boiler water temperature. Replaces the reverse action control. That's why Tankless Heaters can now work as well on forced hot water jobs as they always have on steam. Also of importance, TACO-MATIC operation practically eliminates all expansion noises, particularly on copper pipe installations.

Try this low cost TACO-MATIC valve on your next forced hot water job. **You save the cost of a reverse action control.**

PERFECT FOR THE SMALL HOUSE



AND SMALL WATER CONTENT BOILERS

**Better Heating-Better with Taco**

Taco

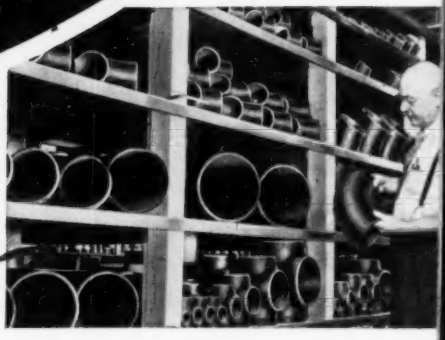
**TACO HEATERS, Incorporated**

**137 South Street—PROVIDENCE 3, R. I.**

In all the world there's only one TUBE-TURN Welding Fitting as shown by this trade mark... the right mark for every need in welding fittings and flanges.

TUBE-TURN

TRADE MARK



More than ever, the services of your TUBE TURNS Distributor can be important to the smooth operation of your business.

**TUBE TURNS, INC., LOUISVILLE 1, KENTUCKY** DISTRIBUTORS IN ALL PRINCIPAL CITIES

DISTRICT OFFICES: NEW YORK • PHILADELPHIA • PITTSBURGH • CHICAGO • HOUSTON • TULSA • SAN FRANCISCO • LOS ANGELES

*In Canada . . . Tube Turns of Canada Limited, Chatham, Ontario*

*LAURENCE H. CARR* is now director of engineering and research for *EDWARD VALVES, INC.*, East Chicago, Ind. He has been a member of the firm's technical staff since 1936 and was previously chief metallurgist. *CARL W. NEDDERMAN*, for 15 years affiliated with metal working industries in an executive capacity, has been elected assistant vice president of the company. *RALPH A. MUMERT* has been named a sales engineer with *F. J. HEARTY & CO.*, Los Angeles and San Francisco, west coast representative for Edward. Mr. Mumert was formerly associated with Keenan Pipe & Supply Co.

Last month, *HARRY ERLICHER* completed a half a century with *GENERAL ELECTRIC CO.*, Schenectady, N. Y. Throughout his years with the company, he has moved through a series of positions. In 1910 he was a buyer. Some 13 years later he was assistant purchasing agent, and in 1931 became general purchasing agent. In 1940 he was elected a vice president and had attained the position of chief of purchasing and traffic, which he now holds.

*W. L. SNELTJES* is now supervisor of advertising and sales promotion for the company's air conditioning department, Bloomfield, N. J. He succeeds *FRED KESWICK*, who has joined the advertising staff of the appliance and merchandising department at Bridgeport, Conn. Mr. Sneltjes will supervise advertising and sales promotion of automatic heating equipment, the company's air-wall heating system and the residential year-round air conditioning units.

The GE air conditioning department has named the regional managers for the four new sales regions. They are: eastern region — *H. N. McMENIMEN*, 570 Lexington Ave., New York City; central region — *S. C. BERNHARDT*, Merchandise Mart, Chicago; southern region — *E. J. GUILLORY*, 511-513 International Trade Mart, New Orleans; and western region — *L. M. LARKIN*, 235 Montgomery St., San Francisco.

*ORR & SEMBOWER, INC.*, Reading, Pa., has named *J. FREDERICK KEELER*, sales manager, to the position of vice president in charge of sales and service and *GEORGE H. GARRAWAY*, director of engineering, vice president in charge of engineering and production. Mr. Garraway, who joined the firm in 1947, has had wide experience in his field. Mr. Keeler has been with the firm since 1948 and is now supervising all phases of sales, sales promotion, and service.

*OHIO INJECTOR CO.*, Wadsworth, Ohio, has established five major sales divisions, each functioning under a field manager reporting to *H. G. SMITH*, vice president in charge of sales. The new divisions and their respective managers are: New York division (New York City, southern Connecticut and northern New Jersey) — *DANIEL J. MOONEY, JR.*, New York City; Atlantic division (Mobile, Ala., to Portland, Me., excepting the New York division area) — *PAUL E. WARNER*, Philadelphia; central division (Minneapolis to Buffalo, St. Louis to Pittsburgh) —*W. G. SHEPHERD*, Wadsworth, Ohio; mid-continent division (Denver to Kansas City, El Paso to New Orleans)


# These men are working for you

C. B. McLAUGHLIN, active, fast-thinking Manager of Tube Turns' Engineering Service Division, checks important design point on new application idea.

Enthusiastic, enterprising G. A. GAUM, Sales Engineer, winds up extensive field trip with information that may save Tube Turns' customers time and money.

D. R. CHEYNEY, alert, ingenious Sales Engineer, visits a Tube Turns' customer with recommendations on alloy fittings designed to whip corrosion problem.

Conscientious, analytical J. D. TOLLIVER, Sales Engineer, goes into the field for performance data that can result in important contribution to piping technology.

IMPORTANT link between Tube Turns, Inc. and its customers is the group of skilled, experienced engineers who staff its Engineering Service Division. Their job: to expand piping technology through studies of piping performance and problems in the field; to enlarge the scope and utility of Tube-Turn welding fittings and flanges.

Today, the men of Engineering Service are making allies of alloys, solving major piping puzzles, extending the advantages of welding fittings and flanges to non-piping fields. Examples: development of the first aluminum flanges, making possible all-welded, all-aluminum piping systems; design of lighter, stronger truck axles fabricated with Tube-Turn welding fittings.

Ideas are their stock-in-trade . . . ideas focused on one basic objective: *new and better ways for welding fittings and flanges to serve you better.*

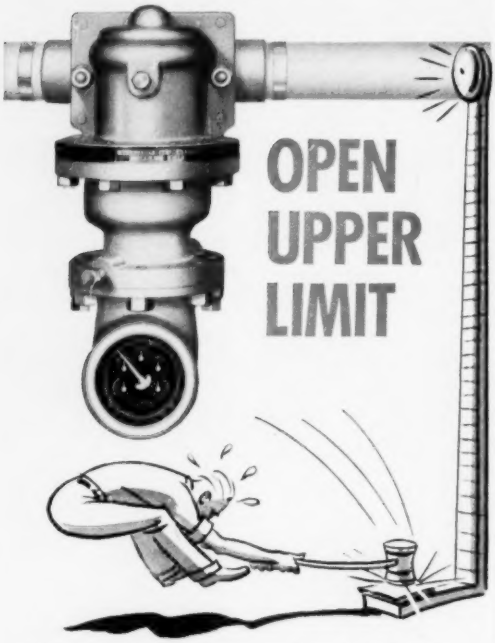
Write for free booklet on "TUBE-TURN Aluminum Welding Fittings and Flanges."

**"Be Sure You See The Double tt"**

**TUBE TURNS, INC.**

**LOUISVILLE 1, KENTUCKY**

**ANOTHER IMPORTANT FEATURE OF SHUNTFLO STEAM METER**




Builders SMDH Shuntflo Steam Meter "rings the bell" wherever steam is used or sold. It totalizes *all* flow over a wide range and meters the heavy temporary overloads that come when steam is supplied to cold lines, tanks, etc. At these peak loads the Shuntflo Meter speeds up and measures excess rates up to 150% of normal capacity without damage to the mechanism. This "open upper limit" means you totalize every pound of steam delivered. A direct-reading totalizer shows within ±2% how many pounds of steam—or cubic feet of air or gas—have passed through the pipe line.

The Shuntflo Meter is widely used by district heating companies, process industries, and commercial buildings whose engineers must know *where* steam is consumed and *how much!* For complete information and new Bulletins 400-F1 and 400-F2, address Builders-Providence, Inc. (Division of Builders Iron Foundry), 381 Harris Avenue, Providence 1, R. I.

**BUILDERS PRODUCTS**

Flow Meters and Controllers . . . Mechanical and Differential . . . for Liquids, Steam, Air, and Dry Materials.

The Venturi Meter

Chlorinizers — Chlorine Gas Feeders

**BUILDERS PROVIDENCE** *Instruments*


—*A. A. KRUSE, JR.*, Dallas; Pacific division (Los Angeles to Seattle) —*DENNY GORDON*, San Francisco.

The International Division of *FOSTER WHEELER CORP.*, New York City, was recently formed to handle the foreign business of the company and to coordinate the activities of subsidiary companies in Canada, England and France. *LEE ALLAN SWEM* is now vice president in charge of the division. He joined the corporation in 1936 as patent counsel and was elected vice president in charge of the legal department in 1948. *E. F. WENTWORTH, JR.*, has been named to head the legal department, with the title of general attorney. He has been with the company since 1941 and for 12 years prior thereto was engaged in general and patent law practice in New York City and Newark, N. J.

*ALBERT J. NESBITT*, president, John J. Nesbitt, Inc., and long prominent in the civic and business life of Philadelphia, has been selected as general chairman of the 1951 Community Chest campaign. He has served previously as industry and finance group section and division chairman and is on the board of the national organization, Community Chest and Councils of America, Inc..... *A. E. HESS*, who has had 27 years of experience in the manufacture and distribution of oil burning equipment of all types, is now manager of the general division of *YORK-SHIPLEY, INC.*, York, Pa. He was formerly managing director of Oil-Heat Institute of America, and during the past year was sales manager for Lustron Corp.

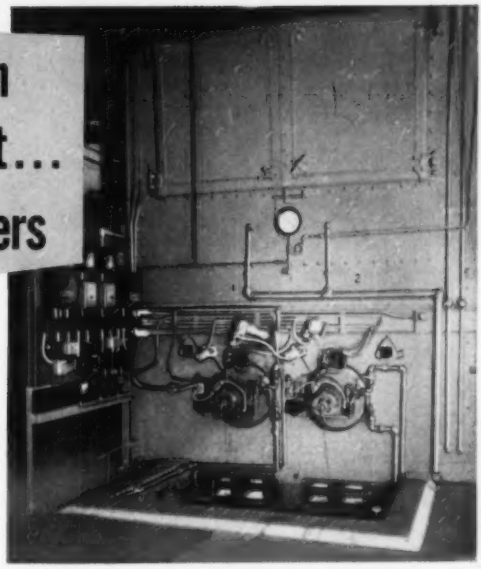
The new vice president in charge of sales and contracts for *HAMMEL-DAHL CO.*, Providence, R. I., is *JOHN O. TRAGARD*, for 20 years with the Foxboro Co. as sales executive and legal counsel and for four years with Fulton Sylphon Div., Robertshaw-Fulton Controls Co. *MAURICE MacDONALD* is a new Hammel-Dahl vice president and is manager of engineering. For the past eight years he has been chief engineer in charge of instrumentation and control for M. W. Kellogg Co.

*GUS A. BINZ*, for the past 20 years sales promotion manager for *SARCO CO., INC.*, New York City, has established himself as an independent advertising agent, *GUS BINZ ASSOCIATES*, 332 Springfield Ave., Summit, N. J., and the first of the year will take over the Sarco advertising account.....*JOHNSTON PUMP CO.*, Los Angeles, has elected *KENNETH G. LUNDIE* vice president in charge of sales and *PERRY BROWN* vice president in charge of engineering. Mr. Brown has been chief engineer and Mr. Lundy has been sales manager. Both men have been in the vertical turbine pump field for many years.

*STEPHEN F. KEATING*, who joined *MINNEAPOLIS-HONEYWELL REGULATOR CO.*, Minneapolis, in 1948 as executive assistant in the aeronautical division, is now an assistant secretary of the company. He has been director of military contracts. *RAYMOND O. ANDERSON*, assistant director of research, has been designated as the company's representative in an atomic study program for industry being sponsored by the Atomic Energy Commission.

# Today's *FINEST VALUE* in Heavy Oil Burning Equipment...

## *Ace* UNIFLOW Oil Burners



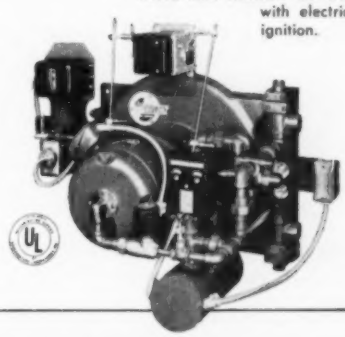
Two ACE UNIFLOW Oil Burners installed at J. Langrall and Bro. Canning Plant, Baltimore, Md.
**C. Hoffberger Company, Contractors**

In the installation shown here, two ACE UNIFLOW Oil Burners, each with a capacity to burn 100 g.p.h. of heavy oil, were selected by Kalman Steiner, noted oil burner authority and manager of the heavy oil burner division of C. Hoffberger Company.

The unique two-burner installation was designed to handle efficiently a difficult and highly variable steam demand in this canning plant, which at times is 200% of the boiler rating.

This is just another of the many applications of ACE UNIFLOW Oil Burners in commercial and industrial buildings where their combination of quality and economy gives finest value.

Type DREH fully-automatic, direct drive Ace Uniflow Oil Burner with electric-gas ignition.



### TEN SIZES GIVE FOLLOWING RANGE OF CAPACITIES

| | Gallons Per Hour | Boiler H. P. | Square Feet Steam Rad. |
|---|---|---|---|
| Minimum | 4 | 12 | 1,600 |
| Maximum | 165 | 500 | 66,000 |

*Ace* UNIFLOW OIL BURNERS ®

*"Custom Engineered for Discriminating Buyers"*

**ARCHITECTS, ENGINEERS, CONTRACTORS . . .**

**Get full information now on the advantages of ACE UNIFLOW Oil Burners for commercial, industrial and institutional buildings! An Ace Manual for architects and engineers is yours for the asking.**

**GET FULL DETAILS TODAY!**

# ACE ENGINEERING COMPANY

**1435 WEST 15th STREET • CHICAGO 8, ILLINOIS**

# WEBSTER KINETIC* GAS BURNER

- Designed for LOW GAS PRESSURE
- Will Operate at ONE POUND
- Will TURN DOWN to 1/2" Water
- Fires a SCOTCH MARINE BOILER without a dutch oven or refractory lining
- Will operate through a FIRE DOOR
- Will NOT VIBRATE
- Draft Loss VERY LOW
- This Gas Burner is available in ANY SHAPE and SIZE
- INTEGRALLY MOUNTED pilots

*For WEBSTER KINETIC BURNER*

*Information Write—*

**THE WEBSTER ENGINEERING COMPANY**

**P. O. Box 2168 — Tulsa, Oklahoma**

**Trade Mark*


*JACK A. MARSHALL*, who has been in the Atlanta office for four years as a sales engineer, is now commercial division sales manager for the southeast region, with offices in Atlanta. *R. H. SCHULTZ* has been named Milwaukee branch manager, and *J. P. MANIS* is the new district manager at Memphis. Mr. Schultz was formerly in the St. Louis office and has headed the Memphis branch since 1947. Mr. Manis has been in the Chicago sales and factory organization. For the last three years he has been the senior commercial salesman at Chicago.

*GERALD C. QUINN*, editor since 1945 of the house organ published by *ALLIS-CHALMERS MFG. CO.*, Milwaukee, is now supervisor of industrial press relations. He succeeds *N. H. JACOBSON*, who has joined the Atomic Energy Commission in the newly created position of technological information officer. . . . . *J. L. GIBSON*, manager of the commercial refrigeration and air conditioning engineering department, *FRIGIDAIRE DIV., GENERAL MOTORS CORP.*, Dayton, Ohio, has been named an assistant chief engineer. He will have general supervision of engineering work in connection with commercial and air conditioning equipment, materials and processes. *M. W. BAKER* takes over his former post.

*WILLIAM C. CROFT*, formerly assistant to the president of Harvill Corp., has been appointed works manager of *PYLE-NATIONAL CO.*, Chicago. . . . . *B. W. WESTCOTT* has been elected vice president of *HOWELL ELECTRIC MOTORS CO.*, Howell, Mich., and *JAMES F. MURPHY* has been appointed general sales manager. Mr. Murphy was formerly with General Electric Co. and has a background of more than 20 years in the electrical and air conditioning fields.

*AIRTEMP DIV., CHRYSLER CORP.*, Dayton, Ohio, has appointed *R.B. STOTZ* to executive engineer in charge of all Airtemp Construction Corp. work in metropolitan New York and surrounding area. He joined the division in 1945 as a field engineer . . . . . *CARL F. HERBOLD* is now director of manufacturing planning for the small motor division of *WESTINGHOUSE ELECTRIC CORP.*, at Lima, Ohio. He was formerly manager of industrial relations at the small motor plant and is succeeded in that position by *K. H. SMITH*, assistant manager of industrial relations.

*VEARL J. HEINIS* is the new national sales manager for space and central heating products of *RHEEM MFG. CO.*, Chicago. He will continue to make his headquarters at the company's Chicago plant. Until recently assistant appliance sales manager for the central region, Mr. Heinis has been identified with the heating business and related fields for 15 years.

Leaders of the construction industry have formed two special committees to cooperate with the federal government on national security problems in this field. Both are subcommittees of the Construction and Civic Development Department Committee of the *CHAMBER OF COMMERCE OF THE UNITED STATES*. Heading the subcommittee on construction mobilization is *RALPH WALKER*, New York, president of the American Institute of Architects. Also on this committee are *HAROLD E. McGREGOR*,

# .... the BEST BUY for

# INCREASED ATTENTION and LASTING SALES POWER

## THE JANUARY 1951 ISSUE

*and 17th Annual Directory Number of*

## HEATING, PIPING & AIR CONDITIONING

### DIRECTORY SECTION . . . .

Every product used in industrial and large building air conditioning, heating and piping will be listed. We'll tell who makes these products and their trade names. All advertisers as they appear in this Directory Section will be prominently identified indicating that more detailed information is elsewhere in the issue. It's the industry's best and most complete BUYING GUIDE—printed on colored stock in a special section.

### SHOW SECTION . . . . . .

The January Number will preview the 10th International Heating, Ventilating, and Air Conditioning Exposition, Philadelphia, January 22 to 26. We will cover it completely . . . for those who attend, a *"where to go"* and *"what to see"* Guide—for those who can't go, the highlights of the show in print. Subscribers will get January HP & AC well in advance of the Show's opening date.

### STANDARD EDITORIAL CONTENT . . . . . .

January HP & AC will be a "regular issue" in every respect. It will carry a full quota of timely articles, and the Journal Section of the American Society of Heating and Ventilating Engineers—the same as in every issue of this field-leading book. For extra attention value, it will have heavy covers, and be specially mailed.

**Here's a regular issue, a directory issue, a show issue—all combined in one great January number . . . . and *no advance* over regular issue rates!**

**Here your advertising will get *increased attention*, and have *lasting sales power* (as catalog reference copy) throughout all of 1951.**

**Here is the "best buy" of the year in our field . . . . the place where a convincing sales story of your complete facilities will do you untold good.**

**Here is where *extra* space for *extra* emphasis belongs!**

Most advertisers use increased space with us in January —spreads, inserts, color. They catalog their entire lines. You, too, can profit most by doing a complete job. Make space reservation now . . . . we'll be glad to help with copy preparation if needed.

**Heating, Piping & Air Conditioning**

**6 North Michigan Avenue**

**Chicago 2, Illinois**

**...with DE BOTHEZAT VERTICAL DISCHARGE ROOF VENTILATORS**

Now fumes that are injurious to roofs can be exhausted *straight up* into the air at high velocity with DeBothezat Vertical Discharge Roof Ventilators. Roofs of foundries, machine shops, steel mills, chemical plants and numerous other industrial buildings —as well as adjoining properties— require this extra protection.

DeBothezat Vertical Discharge Roof Ventilator is a motor-driven fan in a weatherproof housing. Unit provides controlled ventilation at all times, regardless of outside wind or weather. Available with fan wheels 36", 42", and 48" in diameter, with capacities up to 40,900 cubic feet of air per minute.

Keeping the air in your plant pure and free from harmful dust and fumes is as important in winter as in summer. DeBothezat Vertical Discharge Roof Ventilators satisfy this need. SEND FOR FREE BULLETIN.

**DeBOTHEZAT FANS DIVISION**
American Machine and Metals, Inc.
EAST MOLINE, ILLINOIS

Cambridge, Mass., a past president of the Heating, Piping & Air Conditioning Contractors National Association, and *ARTHUR F. NASS*, Pittsburgh, chairman of the governmental affairs committee, National Association of Master Plumbers.

*WILLIAM J. LATCH, JR.*, is managing the Baltimore branch sales office of *NATIONAL RADIATOR CO.*, Johnstown, Pa., and has assumed the responsibilities of *LESTER R. SNYDER* who died last August. Mr. Latch joined the firm in 1936 and in 1939 was named a sales engineer..... *BUENSOD-STACEY, INC.*, New York City and Charlotte, N. C., has initiated a new service consisting of periodic calls upon all clients, especially in the industrial field. by *W. J. McDONALD. R. W. WATERFILL*, vice president of the firm, is scheduled to deliver lectures on refrigeration equipment and systems at the second annual seminar on new developments in heating and air conditioning, to be held under the auspices of the college of engineering, New York University.

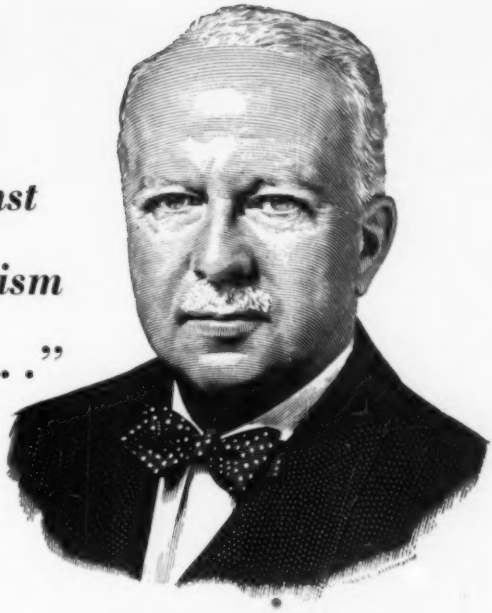
As the new chief design engineer of *SHARP & DOHME, INC.*, Philadelphia, *WILLIAM W. BROWN*, formerly assistant chief engineer, will supervise and direct the design and preparation of plans and specifications for equipment and facilities needed by the company's various plants. He succeeds *ROBERT H. BAXTER* who was recently appointed head of the newly organized industrial engineering group. .... *ARTHUR G. STOUT & ASSOCIATES*, Chicago consulting engineers, have moved to 162 N. Clinton St., Chicago 6.

*WILLIAM C. HOOKWAY, JR.*, formerly with H. A. Wilson Co. and for eight years a marine engineer with Gibbs & Cox, Inc., is now assistant to the chief engineer of *COOPER ALLOY FOUNDRY CO.*, Hillside, N. J. *JAMES ZIEGLER*, sales representative of the Pittsburgh-Cleveland district, is covering the New Jersey territory. ..... *JOHN J. COTTER* is now managing sales of *GENERAL FITTINGS CO.*, Providence, R. I. He has had wide experience during his many years in the industry.

*P. J. GALLAGHER*, has been named general sales manager of *HINDERLITER TOOL CO. DIV., H. K. PORTER CO., INC.* Formerly district sales manager for Porter in Detroit, he is now located at the company's main office and factory in Tulsa, Okla. .... *C. F. KREISER*, formerly assistant sales manager, and *W. J. ARNOLD*, formerly manager of industrial applications, are now general sales manager and industrial sales manager, respectively, for *EDWIN L. WIEGAND CO.*, Pittsburgh. Mr. Kreiser joined the company in 1946 as a sales engineer, and Mr. Arnold has been associated with the firm since 1944.

*LEONARD C. BASTIAN*, well known throughout the refrigeration and air conditioning industry for his work as technical director of the Air Conditioning and Refrigerating Machinery Association during the past twelve years, has joined the engineering staff of *PHILCO CORP.*, Philadelphia. *J. R. SCHREINER*, formerly associated with the research laboratory of Pennsylvania State College, has joined *ACRMA* at its Washington headquarters as a staff engineer.

*"The immunizer against the disease of communism is a certain feeling . . ."*



**MR. WALTER S. GIFFORD**

**"It is the feeling of a man who owns a home, a bank account, an insurance policy. *It is the feeling that an employee on the Payroll Savings Plan has when he gazes at his accumulation of Savings Bonds and realizes that here is palpable evidence that he has made a profit on his job—that the profit system works for him as well as for his employer."***

Mr. Gifford has believed in—and worked for—payroll savings plans for thirty-seven years—since 1913, when, as Statistician of the A. T. & T., Mr. Gifford developed a payroll savings plan for the purchase of A. T. & T. stock.

In 1938, A. T. & T. employees were offered a Payroll Savings Plan for the purchase of U. S. Savings Bonds. To date, Bell System employees have invested ***more than half a billion*** dollars in savings bonds—with a maturity value in excess of $675,000,000.

In upwards of 21,000 large companies, more than 8 million Americans are investing $150,000,000 in U. S. Savings Bonds ***every month.*** To the systematic saving of these men and women—and the whole-hearted co-operation of executives like Mr. Gifford—is due in no small measure the important feeling of ownership shared by the Americans who own 56 billion dollars in U. S. Savings Bonds (against 45 billions at the end of the war!).

Every Payroll Savings Plan is a reflection of the vision and enthusiasm of the top executive of the company. If he gets behind it, ***personally,*** employee participation is high—to the benefit of the country, the company and the employee. If the interest of the Big Boss is active—participation may very well exceed the 50% mark. The top man is the key man in a Payroll Savings Plan.

Get in touch with your State Director, Savings Bond Division, U. S. Treasury Department. He will help you put in a plan . . . or he will show you how to increase employee participation—without undue effort or high pressure tactics.

The U. S. Government does not pay for this advertising. The Treasury Department thanks, for their patriotic donation, the G. M. Basford Company and

**HEATING, PIPING & AIR CONDITIONING**

Appointments of new plant managers for two *OWENS-ILLINOIS GLASS CO.* plants involve three men. *CARL H. SMITH*, manager at the Muncie, Ind., plant of the company's subsidiary American Structural Products Co., will retire next month. His place will be taken by *JOHN E. BAUER*, manager of the Berlin, N. J., plant of the company's Kaylo Division. *GEORGE WALKER* will move from the Kaylo plant in Sayreville, N. J., to become plant manager at Berlin.

An independent field sales organization has been set up by *MINNEAPOLIS-HONEYWELL REGULATOR CO.*, for its valve division. The nucleus of the new organization will consist of regional sales managers and a staff of upwards of 20 men who will provide national coverage. In addition, the company will make use in some areas of field staffs now assigned to industrial, commercial and other products of various company divisions.

Regional managers are: eastern region—*R. SCHLEGEL*; mid-Atlantic region—*T. L. SMITH*; central region—*GEORGE W. BROWN*; midwest region—*R. R. SCOTT*; southeast region—*L. CROWE*; southwest region—*C. F. WOODS*. The mountain, north coast, and Pacific regions will be managed by *W. A. CLEMENTS*, and the northwest region by *R. R. SCOTT*.

*R. D. HOLLINGSWORTH* has been added to the sales staff of *GENERAL CONTROLS*, Glendale, Calif., and will cover the Cleveland, Buffalo and Cincinnati territory. He will work out of the Cleveland branch office and will specialize on the company's line of refrigeration controls. *J. B. MILLER*, in Washington, D. C., is now calling on various government agencies in connection with the company's line of aircraft controls.

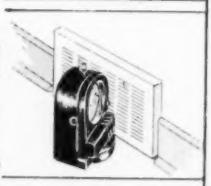
*LEIGH W. HAEFLE*, who joined *AIR REDUCTION CO., INC.*, New York, in 1938, is now assistant chief engineer of the general engineering department. . . . *KARL H. NORBY* is the new air conditioning and heating representative of *McQUAY, INC.*, Minneapolis, in the western half of the state of Washington. Well known in air conditioning and heating circles on the west coast, he will make his headquarters in Seattle.

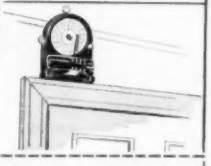
*WIGTON ABBOTT CORP.*, engineering and contracting firm of Plainfield, N. J., has named *JAMES F. SMYTHE*, former assistant to the head of design and construction for Ebasco Services, Inc., to the position of contracting engineer..... *LESTER W. WATSON* is now handling New England sales engineering representation for *COMBUSTION CONTROL CORP.*, Cambridge, Mass. He has an extensive background in the design and application of electronic equipment..... *ROBERT PORTER*, 515 Yazoo St., Jackson, Miss., is the new representative for southern Mississippi of *ANEMOSTAT CORP. OF AMERICA*, New York City.

*C. F. VOILES*, who has been located in the main office of *AIRTHERM MFG. CO.*, St. Louis, is now a sales engineer in the Chicago office. While in St. Louis, he served in the engineering department and in the sales department


PORTABLE TEMPERATURE RECORDER . . .

*Indispensable* for SALES, INSTALLATION and SERVICE





"Very useful for selling installation jobs."

"Very satisfactory for recording outdoor temperature for 'degree day' operations."

"Makes it easy to check proper thermostat location."

"Used all the time for balancing heating systems."

"Gives me proof of a good installation."

"Has been invaluable as proof in settling heating complaints."

"Helped me discover incorrect 'night set-back' of clock thermostat in seconds instead of hours."

The **TEMPSCRIBE** Temperature Recorder gives continuous time-temperature records of room temperature or of air temperature at any specific point, such as at the thermostat, at floor and ceiling levels, and above the radiators or in front of warm air registers. The temperature graph, as recorded on a 4" chart, shows at a glance the highest and lowest temperature during the test period, duration of any temperature extreme, and frequency and spread of temperature fluctuations. The instrument is compact, self-contained; no electrical connection; requires no watching. Can be stood anywhere or hung on wall. Available in ranges to cover —30° F. to +160° F. temperatures. Choice of spring wound chart drives: 8 hour, 24 hour, or 7 day rotation.

**BACHARACH INDUSTRIAL INSTRUMENT CO.**
**7000 Bennett Street · Pittsburgh 8, Pa.**

***Ask your jobber about TEMPSCRIBE Recorders, or mail coupon for Bulletin 720***

Bacharach Industrial Instrument Co., 7000 Bennett St., Pittsburgh 8, Pa.
***Send Bulletin 720 on TEMPSCRIBE Recorders to:***

Name_____

Company_____

Street_____

City and State_____

***We are:*** ☐ DEALER ☐ JOBBER ☐ MANUFACTURER

# Announcing

## ASCO "MIDGET" SIZE TWO-WAY AND THREE-WAY SOLENOID VALVES

This is the new small ASCO Two-Way Solenoid Valve . . . only 2-13/16" from the top of the solenoid housing to the bottom of the valve body. The Three-Way Valve or the Two-Way Valve designed for Normal Open Operation is only slightly larger, being only 3-5/16" from top to bottom. (The latter valve is the lower picture.)

These Midget Two-Way and Three-Way Valves have many applications in the control field because of their compactness, sturdiness and efficiency. The Two-Way Valve comes in two pipe sizes: 1/8" and 1/4" Normally Closed (closed when de-energized) and 1/8" Normally Open (open when de-energized). The Three-Way Valve comes in one pipe size only: 1/8". Both are standard in brass or stainless steel. Permissible pressures: Two-Way Valves up to 300 lbs./sq. in. (AC) and up to 250 lbs./sq. in. (DC); Three-Way Valves up to 125 lbs./sq. in. (AC) and up to 50 lbs./sq. in. (DC). Adjustable Main Flow and By-Pass Flow available for Two-Way Valves. Twenty-Four inch (24") leads.

If you have been looking for a really small and really efficient solenoid valve, one of these two ASCO Midget Valves may be just what you need. We'll be glad to send you complete information (Bulletins 8262 and 8314) but in writing will you tell us something about your requirements?

*These valves will be exhibited in Booth 550-551 at the New York Power Show, November 27th to December 2nd.*

ASCO Solenoid VALVES

When in need of Automatic Transfer Switches, Remote Control Switches, Contactors, Relays, and Specialized Electromagnetic Controls, come to us.

## Automatic Switch Co.

389 LAKESIDE AVENUE · ORANGE, NEW JERSEY

---

*Because they're years ahead in steam generation . . .*

# only CYCLOTHERM STEAM GENERATORS

Trade Mark Reg.

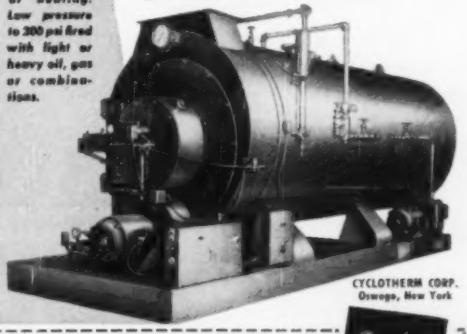
## HAVE the REAL * ANSWER TO Low GAS and OIL CONSUMPTION

**WHAT IS IT?** It's the modern scientific discovery of transferring heat at the highest degree of efficiency with a new low in fuel consumption. Principal factors of which are the cylinderized solid flame with its exclusive cyclo-motion power, designed to utilize the full potential of every particle of fuel . . . and the thin layer of air resulting from centrifugal force that's always between the flame and wall of combustion chamber. A combination to produce steam far in excess of conventional standards for measured heating surfaces.

**SEND FOR *ALL* THE BIG REASONS**

Learn how the completely automatic Cyclotherm with its unexcelled all-in-one package type features wipe out waste and excess costs. If you are planning a new or replacement boiler installation it will pay you to first get the facts on Cyclotherm. The coupon below is for your convenience.

***SIZES** available to fit your steam or water load for processing or heating. Low pressure to 300 psi fired with light or heavy oil, gas or combinations.*



CYCLOTHERM CORP.
Oswego, New York

**CYCLOTHERM CORP., OSWEGO, N. Y.**

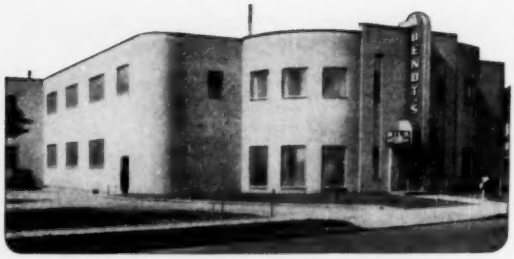
Gentlemen: Please send me bulletin H-1 showing the advantages of Cyclotherm's new concept in Heat Transfer. Without obligation, of course.

Dept. HP-11

NAME _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

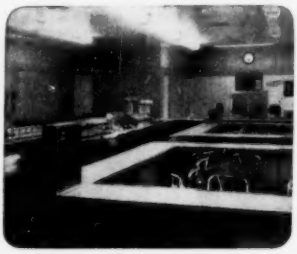



**Frick Refrigeration**

**HELPED BUILD THIS $600,000 DAIRY PLANT**

Twenty-six years ago Edwin J. Wendt started in the milk business with one route and one small Frick refrigerating machine.

Today his new plant at Niagara Falls, N. Y., serves 18 routes, makes 1500 gal. of ice cream daily, has a wonderful dairy bar, and uses six Frick compressors—one a booster for low-temperature work. Installation by Mollenberg-Betz Machine Co., Frick Sales-Representatives in Buffalo.



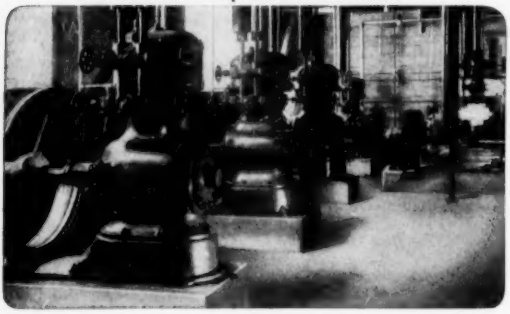
The Dairy Bar is Air Conditioned

Another proof that "the users of Frick Refrigeration make money." Put YOUR cooling problems up to the nearest Frick sales-engineer.

DEPENDABLE REFRIGERATION SINCE 1882
FRICK CO.
WAYNESBORO, PENNA. U.S.A.

*Also Builders of Power Farming and Sawmill Machinery*

Six Frick Compressors at Wendt's



..... As general manager of *JARECKI MFG. CO. DIV., H. K. PORTER CO., INC.*, with headquarters in Houston, Tex., *CHARLES L. WHITE* is responsible for the overall operation of all the company's oil field supply stores. He joined the organization last February as district manager of the west Texas stores.

*RUSSELL M. MacDONALD* is the new district sales representative in the New England area for the stoker and heating division of *FAIRBANKS, MORSE & CO.*, Chicago. With headquarters in Salem, Mass., he will have charge of sales in the New England area for the company's complete line of heating equipment..... As a new sales representative of *PYLE-NATIONAL CO.*, Chicago, *FREDERICK A. GAYER* is handling industrial and distributor accounts in eastern Pennsylvania. Prior to joining the firm, he was associated with Westinghouse Electric Supply Co. for 11 years.

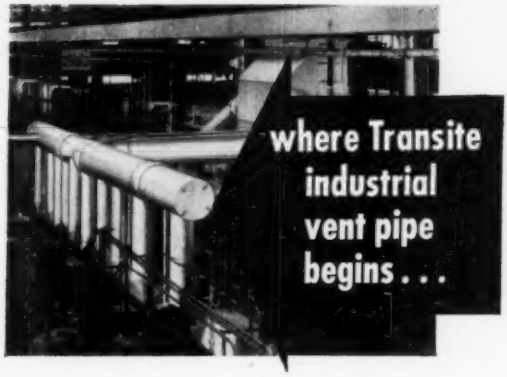
The new sales representative in the Detroit area for *WARD LEONARD ELECTRIC CO.*, Mt. Vernon, N. Y., is *JESSE W. EAKINS CO.*, 3105 E. Grand Blvd., Detroit 2. . . . *LAVERNE N. ZIMMERMAN* has been appointed a district representative of *L. J. MUELLER FURNACE CO.*, Milwaukee, and has been assigned to a territory covering parts of New York, Pennsylvania, and Massachusetts. He has been associated with the heating industry for many years and has now established his headquarters in Kenmore, N. Y.

*U. S. AIR CONDITIONING CORP.*, Minneapolis, has opened a new sales office at 516 Maverick Bldg., San Antonio, Tex. *ROBERT DAWSON*, former field representative for the company's packaged air conditioning products in the southwest area, is in charge. . . . . *FOXBORO CO.*, Foxboro, Mass., has opened two new branch offices. *KENNETH L. BARTON*, a 25-year man with the company who is well known in industrial circles in the New York area and along the Atlantic Coast, is in charge of the office at 214 W. 10th St., Wilmington 1, Del. *ROBERT C. CAHILL* is the resident engineer located at 225 S. 5th St., Minneapolis 2, Minn.

*W. H. BRADY CO.*, Chippewa Falls, Wis., has appointed *WILLIAM E. SCHNEIDER* merchandising manager. He was formerly advertising manager of Prest-O-Lite Battery Co., Inc., a subsidiary of Electric Auto-Lite Co. . . . . *A. O. SMITH CORP.*, Milwaukee, has made a number of changes in its product service division. *J. J. BOHMRICH*, former manager of the division, has been named group executive over the product service, railroad products, and welding electrode and equipment divisions. Replacing him as manager of product service is *J. W. SPOOR*, former assistant manager, who will also direct operations of the Chicago product service branch.

*E. R. DICKINSON*, who has been manager of the Chicago branch, has been transferred to the eastern branch at Union, N. J., as manager, succeeding *C. L. TRACEY*, who has moved to the New York district office. At the Dallas branch, *J. A. SNYDER, JR.*, has been named manager, succeeding *D. R. NEFF* who has resigned.

# Tough venting problems end . . .



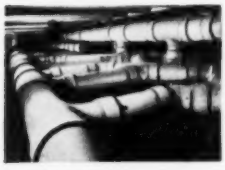

YES . . . Transite* Industrial Vent Pipe solves many a venting problem because it resists the attack of many corrosive fumes, vapors and gases day in and day out . . . and seldom requires maintenance.

That's because Transite is a tough, durable asbestos-cement product that cannot rust or rot. It has a high degree of chemical stability which enables it to stand up for years under corrosive conditions which would destroy many other pipe materials in a much shorter time. It has been able to substantially reduce replacement and maintenance costs for venting systems throughout countless plants in all types of industries.

**It's easy to install**—because Transite Pipe is light in weight, easy to handle. It can readily be cut and drilled with ordinary tools.

**And it's adaptable**—for Transite Pipe comes in a range of sizes up to 36" in diameter that can be used for vents, ducts, or stacks. Furthermore, a complete line of Transite fittings permits you to make your *entire* venting system corrosion-resistant.

Just write to Johns-Manville, Box 290, New York 16, N. Y. for further information on Transite Industrial Vent Pipe. Ask for Data Sheet Series DS-336.



Complete line of fittings enables Transite Industrial Vent Pipe to be fitted to any situation—around sharp curves, changes of direction, manifold connections, etc.

*Transite is a Johns-Manville registered trade mark.

**Typical Industries in which Transite Industrial Vent Pipe is used:**

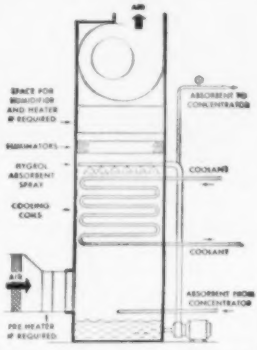
| | | |
|---|---|---|
| Aircraft | Foundry | Pulp & Paper |
| Automobile | Furnace | Quarrying |
| Baking | Furniture | Railroad |
| Bleaching | Gas | Rayon |
| Boiler Works | Glass | Refrigeration |
| Brewing | Laboratory | Rubber |
| Canning | Laundry | Shipbuilding |
| Ceramic | Leather | Shoe |
| Chemical | Match | Smelting |
| Dairy | Meat Packing | Soap |
| Drug | Metal | Soft Drink |
| Electrical | Mining | Sugar Refining |
| Explosives | Paint | Textile |
| Farm Machinery | Petroleum | Tool |
| Food | Potash | Water & Sewage |

**Johns-Manville**
**TRANSITE** Industrial Vent **PIPE**


# How You Save with the NEW Niagara Method of Air Conditioning

## *Using "Hygrol" Hygienic Absorbent Liquid*

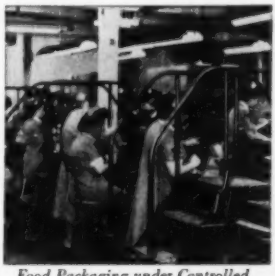
Because it absorbs moisture from the air directly, the new Niagara Controlled Humidity Method uses less, or no, mechanical refrigeration for dehumidifying. You save first costs and installing of heavy machinery. You save space, maintenance expense, power. Easier, convenient operation.



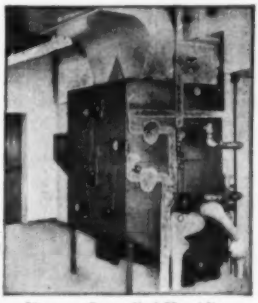

NIAGARA CONTROLLED HUMIDITY METHOD — FLOW DIAGRAM

Using "Hygrol" hygienic absorbent liquid, this method gives complete control of temperature and relative humidity. Especially, it is a better way to obtain dry air for drying processes, packaging hygroscopic materials, preventing moisture damage to metals, and obtaining better quality for chemical process products and food products—or in obtaining better results in comfort air conditioning for office or laboratory at lower refrigeration costs.

The diagram shows how filtered air is dehumidified by passing thru a spray of "Hygrol"— a liquid absorbent which removes air-borne moisture. This liquid is hygienic and non-corrosive; it contains no salts or solids to precipitate and cause maintenance troubles. It is continuously reconcentrated at the same rate at which it absorbs moisture, providing always the full capacity of the air conditioner, automatically.



*Food Packaging under Controlled Humidity*



*Niagara Controlled Humidity Air Conditioner*

Units provide a range of capacities from 1000 to 20,000 C. F. M. Multiple unit installations are in use successfully. Records of results are available.

For further information, write to Niagara Blower Company, Dept. HP 405 Lexington Ave., New York 17, N. Y.

# NEW BOOKS & REPORTS

### Report on Welding Characteristics of Seamless Pipe

Welding Characteristics of Open Hearth And Bessemer Seamless Pipe, by A. B. Wilder, chief metallurgist, W. B. Kennedy, chief metallurgist, National Works, and F. W. Crouch, assistant chief metallurgist, National Works, National Tube Co., explains a new type of weldability test, the weld bead flattening test for tubular products, and reveals results of tensile and bend tests on girth welds of deoxidized acid bessemer steel pipe and of basic open hearth steel pipe.

In the report, the properties of girth welded, grade B bessemer seamless pipe and the weldability of this new material are discussed. A comparison is made with several types of grade B open hearth seamless pipe. One of the grades of open hearth steel was silicon-killed and melted to coarse grained deoxidation practice. This grade is said to be of particular interest because of its improved creep and creep rupture properties. According to the authors, open hearth grade B steel is usually melted to fine grained deoxidation practice and the properties of this type of material are well known. Tensile properties, ductility, and soundness tests of girth welds are compared with other metallurgical properties and weldability tests.

In the weld bead flattening tests, weld beads were deposited in a flat position on pipe rings 6 in. wide with an automatic welding head. The temperature at the start of each weld bead was 80 F and the beads were deposited in a horizontal and longitudinal direction with respect to the major axis of the pipe. After welding, the beads were notched in accordance with the procedure outlined by Offenhauer and Koopman and were aged at 212 F for 24 hr. The notched pipe rings, with the notch at 90 deg from the direction of applied force, were flattened by compression in a tensile testing machine at the rate of 0.5 in. per min until a crack appeared. The distance between plates used in flattening, lateral contraction and width of the specimen, and the maximum load were measured to provide a method for evaluating the weldability of a pipe section.

All materials tested were seamless pipe in the "as-rolled" condition and the chemical-physical properties met ASTM specification requirements for grade B steel pipe. The bessemer steel pipe was made from a special deoxidized steel. Some of the conclusions as reported in the paper are:

The deoxidized bessemer steel had the lowest hardenability when quenched from 1600 F and 2100 F.

The silicon-aluminum killed open hearth and deoxided bessemer steels had a fine austenitic grain size after carburizing at 1700 F and the silicon killed open hearth steel was coarse grained.

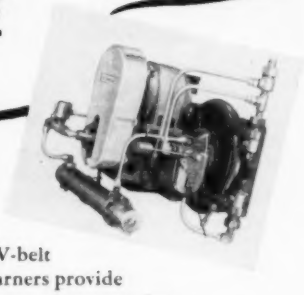
Girth welds met the tensile and bend test requirements of the ASME Boiler Construction Code.

Maximum hardness results in the girth and bead welds were higher in the open hearth steels compared with the deoxidized bessemer steel.

Hardness and microstructure of longitudinal and circumferential weld beads were similar.

Satisfactory impact properties in the girth welds were obtained at —20 F to 750 F in all the steels except the silicon killed open hearth steel at the lower temperatures.

Keep Heating Comfort HIGH
with ENTERPRISE
OIL BURNERS



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*General Contractors:* Swenson Construction Co.
*Heating Contractors:* U. S. Engineering Co.
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In the weld bead flattening tests, all the steels were similar and the notched longitudinal weld-bead tests were the most consistent. The open hearth steels exhibited underbead cracking in the cracking susceptibility tests. Cracks were not observed in the bessemer steel.

This report was presented at the last annual meeting of the American Society for Testing Materials, 1916 Race St., Philadelphia 3.

### Provides Data on Limits of Human Performance, Sensitivity

Technological progress has progressed to a point where human faculties of perception, action, reaction, and decision can now be taxed to such an extent that it is no longer possible to take full advantage of a given machine unless the control of that machine can be tailored to human capabilities. Handbook of Human Engineering Data for Design Engineers supplies information on the practical limits of human performance and sensitivity beyond which man, as a control device for machines, begins to break down.

Prepared by the Tufts College Institute for Applied Experimental Psychology under a research contract with the Navy's Special Devices Center, the book is intended primarily as a reservoir of factual information for the design engineer but will be of interest to production experts in all fields. It is essentially a compilation of known data in each of the fields of human engineering, including summaries of principal experiments and basic bibliographies. It is the intention of the authors to issue supplementary data when available, thus keeping the compilation up-to-date.

Eight broad sections deal with: the human machine and human engineering; the human body (anthropometrics); characteristics of vision; factors influencing the efficiency of hearing; skin sensitivity and proprioception (space orientation); motor responses; physiological factors (sleep, temperature, humidity, ventilation and drugs); and intelligence. A glossary of some five hundred terms used in human engineering is included, as well as an author index and a subject index.

Identified as PB-100-814, this 370 page loose leaf book is available from the Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., for $5.00. Checks and money orders should be made payable to the Treasurer of the United States.

### Cinders From Small Boilers More Troublesome Than Fly Ash

For boilers of 500 hp and under, some sort of fly ash collecting equipment should be provided on all spreader stoker installations and for underfeed stokers operating at firing rates above 25 to 30 lb per sq ft per hr. Low draft loss collectors will meet existing ordinances on practically any underfeed stoker installation. With spreader stoker firing, some existing ordinances permit the use of low draft loss collectors on any installation. Others limit their application to the best designed and best operated plants. If no ordinance exists, high draft loss collectors should be used if the dust loading entering the collector exceeds 2.0 gr per cu ft. With lower dust loadings, low draft loss collectors will generally prevent a dust nuisance. In small stoker fired plants, coarse particles or cinders are more


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**Thermostatic Traps:** ½" to 1" sizes; low, medium, high pressure; wide variety of body styles.

**Float and Thermostatic Traps:** ¾" to 2" sizes; low and high pressure.

**Strainers:** ⅜" to 2" sizes; cast iron or brass bodies. Also *Radiator Valves, Vents, Boiler Return Traps.*

## Temperature Control Valves

120-A Thermotrol Individual Radiator Temperature Control.

**No. 120 Thermotrol:** Self-contained individual radiator temperature control for steam or hot water. Easily installed in place of manual radiator valve. Sizes ½" to 1"; all body styles.

**Tank Temperature Controls:** Self-powered modulating control valves for fluid heaters and all types of process equipment for heating or cooling. Sizes ⅜" to 2".

## Condensation and Vacuum Pumps

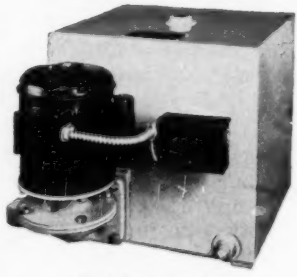
**4100 Series:** Compact, economical condensation pumps with 15 or 30 gallon steel tank, dual voltage capacitor type motor, rotary seal, and simple, sturdy vertical centrifugal pump. For all low pressure jobs up to 14,000 sq. ft. E.D.R. and 20 lbs. pressure.

**4200 Series:** Same as 4100 Series except cast iron tanks.

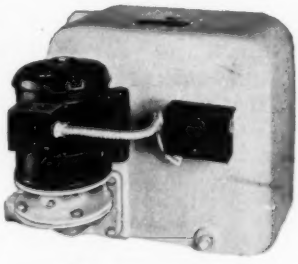
**3500 Series:** Heavy duty condensation pumps with pedestal mounted steel tank, for a wide range of jobs — 2000 to 65,000 sq. ft., up to 150 lbs. pressure.

**3700 Series:** Condensation pumps with heavy cast iron tank for installation underground or in wet locations. 2,000 to 20,000 sq. ft., 20 or 30 lbs. pressure.

**Vacuum Pumps:** Type V, 2500 and 5000 sq. ft., 20 lbs. pressure. Type S, 10,000 to 40,000 sq. ft., 20 to 40 lbs. pressure.



4126-B Condensation Pump (Steel Tank)



4226-B Condensation Pump (Cast Iron Tank)

*Descriptive bulletins with complete specifications of any of the above products will be furnished promptly upon request.*

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**help N. Y. Steam Corp. cut maintenance on about 75 miles of steam lines**

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Maintenance costs could easily get out of hand in such a vast underground system. Best protection? — The best equipment. And in Expansion Joints that means Badger. Since the early 1900's New York Steam Corp. has installed thousands of these famous joints — and maintenance costs have been kept to a minimum.

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- **Directed-flexing rings . . . equalize stresses between and within corrugations**
- **Packless . . . pressure-tight single tube**
- **Compact . . . no larger than flanged fitting**
- **Special forming . . . no structure-weakening stresses**
- **Controlled heat treating . . . assures long life**
- **Fabricated from copper for normal pressures and temperatures, stainless steel or alloys to withstand high pressure, temperature and corrosion**

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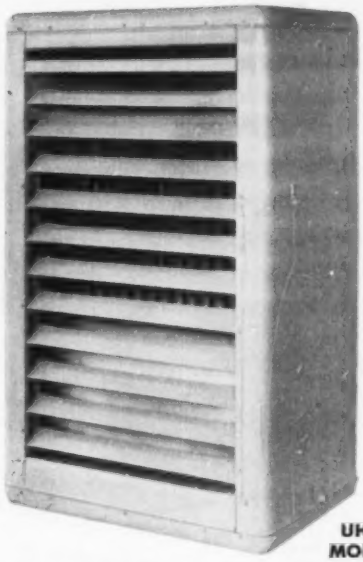
## Two Designs Available



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**A.G.A. Approved for Natural, Mixed, Manufactured or LP Gas**

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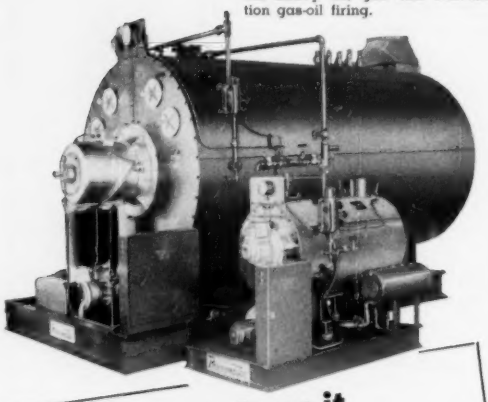
Available in pressures from 15 to 200 p.s.i.—15 to 500 HP.—for light oil, heavy oil, gas and combination gas-oil firing.



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- √ Low fuel consumption through high efficiency
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of a nuisance than fine particles or fly ash, and this should be considered in drafting future smoke ordinances.

These are some of the conclusions of William L. Prout, chief engineer, Green Fuel Economizer Co., Inc., as expressed in his paper, Fly Ash Collecting Equipment For Small Boiler Installations.

After briefly describing typical small plants, the author discusses types of collectors and divides them into two general classes, low draft loss and high draft loss. Selection of collectors is covered and attention is given to the problem of reinjection.

Presented at the last spring meeting of the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, this paper is identified as No. 50-S-33.

### Revises Cast Iron Boiler Ratings

A revised edition of I-B-R Ratings for Cast Iron Boilers has been published by the Institute of Boiler and Radiator Manufacturers. The new edition contains up-to-date ratings for all cast iron boilers currently being produced, and the book is based on research work at the University of Illinois which definitely indicates that the piping and pickup factors used in the I-B-R Boiler Rating Code since 1940 have been too conservative as applied to automatically fired hot water heating systems.

Research work at the University of Illinois has provided the basis for a reduction from 1.53 to 1.33 as the maximum piping and pickup factors for automatically fired hot water boilers. No changes have been made in the ratings of hand fired boilers or in the ratings of automatically fired steam boilers.

Copies of the new edition may be obtained for 50 cents from I-B-R headquarters, 60 E. 42nd St., New York 17.

### Other Books & Reports Received

*HEAT TRANSFER THROUGH GASES AT LOW PRESSURES*, by R. E. Peck, professor of chemical engineering, Illinois Institute of Technology, W. S. Fagan, associate chemical engineer, Argonne National Laboratory, and P. P. Werlein, graduate assistant in chemical engineering, Illinois Institute of Technology—Identified as Paper No. 50-F-16 of the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, it presents the results of a study to determine experimentally the heat transfer between two parallel vertical plates. The space between the plates was filled with a gas at low pressure, and the boundaries of this gas layer were enclosed by a solid heat insulator. The variations of heat transfer with pressure, temperature difference, type of gas, and thickness of the gas layer were determined. Experimental results are compared with both theoretical and empirical equations.

*PAPERS ON RADIOGRAPHY*—Contains papers and discussions of a session on radiography at the 52nd annual meeting of the American Society for Testing Materials, held last year. In an attempt to correlate information on recent developments of radically new equipment and in nondestructive testing, this 95 page paper covered booklet contains eight papers. It is identified as Special Technical Publication No. 96 and can be obtained from ASTM headquarters, 1916 Race St., Philadelphia 3, for $1.75.

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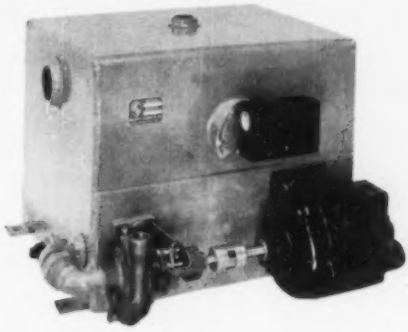

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Here's the best condensate pump "buy" on today's market. It provides far more capacity than any similar pump . . . 8,000 sq. ft. EDR at 20 PSI . . . and it's only **$129.00** (trade price).

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# MEETINGS & CONVENTIONS

*I-B-R HEATING SCHOOL*—Begun in Springfield, Mass., in April and sponsored by the Institute of Boiler and Radiator Manufacturers, 60 E. 42nd St., New York 17, a traveling school is designed to provide an intensive three-day training in heating design and installation. The instructor is Arthur L. Wales, field training director for the institute, and the tuition fee is $18.00. Classes will be held this month in South Bend, Toledo, and Hartford, Conn., and similar sessions will be held next month in Worcester, Mass., and Bridgeport, Conn.

*AIR CONDITIONING OPERATING AND MAINTENANCE SCHOOL*—This month, Bahnson Co., Winston-Salem, N. C., will again conduct an air conditioning school for operating and maintenance engineers. The purpose of the classes is to enable operating personnel to become more familiar with equipment. Covering virtually all component parts of various systems, classes will be held during the weeks of November 13 and November 27. The first week is primarily for evaporative cooling systems and during the second week emphasis will be on systems using refrigeration.

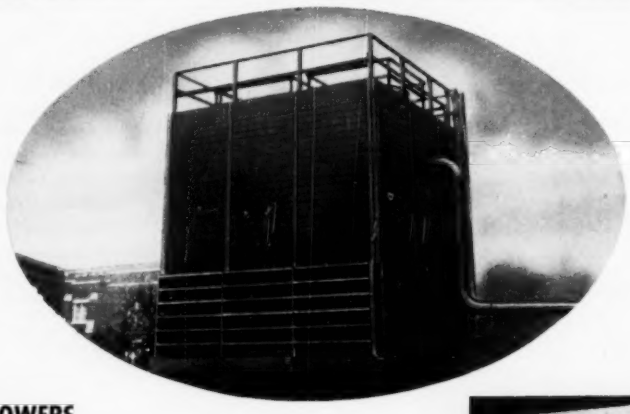
*WEST COAST REFRIGERATION AND AIR CONDITIONING CONFERENCE AND EXHIBIT*, sponsored by the Refrigeration Equipment Manufacturers Association, 1346 Connecticut Ave., N.W., Washington 6, D. C. —To be held November 17 to 19 in the Municipal Auditorium, Long Beach, Calif., and in conjunction with the 13th annual convention of the Refrigeration Service Engineers Society. Other cooperating associations are the Refrigeration Equipment Wholesalers Association and the Refrigeration and Air Conditioning Contractors Association. The latter is holding its annual convention in Long Beach, November 15 and 16 at the Hotel Lafayette.

*19th NATIONAL EXPOSITION OF POWER AND MECHANICAL ENGINEERING*, November 27 to December 2, Grand Central Palace, New York City—The show will be held in conjunction with the annual meeting of the American Society of Mechanical Engineers and, for the first time, will be under the auspices of the society. Show management is being handled by International Exposition Co., Grand Central Palace, New York.

Exhibits will cover all phases of power production and industrial use, including fuel handling, precombustion treatment, combustion, smoke prevention, the control of fly ash, etc.

*AMERICAN SOCIETY OF REFRIGERATING ENGINEERS*, 40 W. 40th St., New York 18—The 46th annual meeting will be held, December 3 to 6, at the Hotel Commodore, New York City.

The program will include a conference on room air conditioners, a symposium on the heat pump, and two general technical sessions. Dr. C. A. Mills, professor of experimental medicine, University of Cincinnati, will describe his new home which incorporates many unusual features of radiant heating, air conditioning, and the principles of reflectivity. Other papers will deal with the restrictor tube as an expansion

Left: United one cell induced draft tower, series M16, in ice plant refrigeration service.

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*for Air Conditioning and Refrigeration*

Complete line "package" type spray towers at low standardized prices. Individually designed and constructed mechanical draft equipment in any required capacity.

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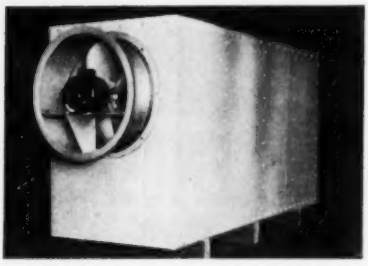

United LoTemp series, forced draft "packaged" unit. 5—7.5—10—15—20 ton capacities.

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**GREENLEE PIPE PUSHER**

Cut costs, save time on underground pipe installations this fast, easy way.

With a GREENLEE Hydraulic Pipe Pusher *one man* can push pipe through the ground and under obstructions.

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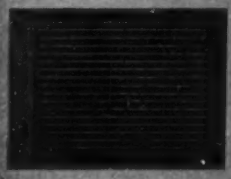
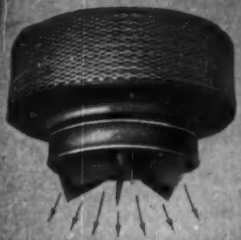
**HEATING AND AIR CONDITIONING PRODUCTS**

**BLAST HEATING COILS—AIR CONDITIONING COILS—ALL TYPES**



All copper spiral fin tube construction with the tubes formed or bent permits uniform expansion without strain. Headers are heavy wall construction with tubes brazed into extended ferrules formed in the headers. Fins are helically wound and metallically bonded. May we send catalog?

**VERTICAL TYPE UNIT HEATERS**



A proven heating unit, modern in design, incorporating every unit heater advancement. McCord copper spiral fin tube construction creates air turbulence without undue restriction. Improved fan blades deliver large volume of air with minimum air noise. Guaranteed for 150 lbs. saturated steam pressure. Specify McCord.

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A time proven heating unit, modern streamlined in design, quiet, yet its rugged construction adapts it to all types of installations, guaranteed for use on No. 150 p. s. i. steam pressure. All copper heating element, individual spiral fin tubes free to expand without strain on joints. Standard motors with standard bases used. Wide range of capacities.

Save fuel with McCord Unit Heaters.

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DETROIT 11, MICH.

TITUSVILLE

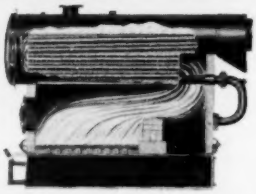
*Compact All Welded*

HIGH FIREBOX

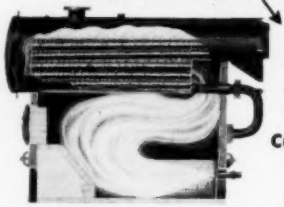
**STEEL HEATING BOILERS**

**Cutaway view to show Type CC Compact Boiler (hand fired)**

1. Large Grate Area
2. Large Furnace Volume
3. Large Disengaging Area
4. Large Steam Volume
5. Long Heat Travel



**These Features Assure More Savings in Fuel and Maximum Heat Output**



1. Long Flame Travel
2. Max. Furnace Volume
3. Reasonable Heat Release
4. Highest Efficiency
5. Longest Life

**Cutaway view to show Type CM Compact Boiler (mechanically fired)**

*Write for complete informative Bulletin B-3000B for CM & CC Types*

Titusville manufactures a Complete Line of High and Low Pressure Fire and Water-tube Boilers to meet all capacity and pressure requirements. *Request bulletin "Meet the Titusville Family."*

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device, lubricants for low temperature applications, and a new 20 ton absorption type air conditioner.

*NATIONAL WARM AIR HEATING AND AIR CONDITIONING ASSOCIATION*, 145 Public Square, Cleveland 14—The 37th annual convention, December 5 and 6, Hotel Statler, St. Louis.

*NATIONAL HEATING WHOLESALERS ASSOCIATION*, 609 Union Commerce Bldg., Cleveland 14—The annual convention will be held December 6 and 7 at the Hotel Sheraton (formerly Coronado), St. Louis.

*AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE*, 1515 Massachusetts Ave., N.W., Washington 5, D. C.—The 117th meeting of the association will be held December 26 to 30, in Cleveland. All 17 of the association's sections and subsections and more than 40 participating societies and organizations are completing plans for an aggregate of more than 200 sessions. The annual Science Exposition will be held concurrently in the Cleveland Public Auditorium.

Housing will be taken care of by the Cleveland Convention Bureau, with hotels confirming reservations directly. Convention hotels include the Statler (AAAS headquarters), Hollenden, Carter, Allerton, Olmsted, and Auditorium.

*PLANT MAINTENANCE SHOW and CONFERENCE*, to be held January 15 to 18 in the Cleveland Auditorium. Advance registration cards and hotel information may be obtained from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, show manager.

A plant maintenance conference, to be held during the first three days of the show, will include discussions of power plant and heating equipment, lubrication, and electrical equipment. Exhibits at the show will include heating, ventilating, and air conditioning equipment.

*AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS*, 51 Madison Ave., New York 10—The 1951 annual meeting will be held in Philadelphia, January 22 to 25. Registration and technical sessions will be at the Bellevue-Stratford hotel, other meeting functions at the Benjamin Franklin and Warwick hotels. For additional information, see page 122.

*10th INTERNATIONAL HEATING, VENTILATING AND AIR CONDITIONING EXPOSITION*—Under the auspices of the American Society of Heating and Ventilating Engineers, the show will be held January 22 to 26, Commercial Museum, Philadelphia. International Exposition Co., 480 Lexington Ave., New York City, is managing the affair.

*STANDARDIZATION SEMINAR*—To assist manufacturing organizations in their standardization work, a private five-day seminar will be held by Dr. John Gaillard, mechanical engineer, American Standards Association, and lecturer at Columbia University. The dates are January 22 through 26 and the place is room 501-A, Engineering Societies Bldg., New York City. Ten conferences are

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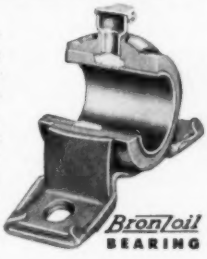
This is the Dodge Bronzoil Bearing—one of the most remarkable items available to fan and blower manufacturers. Engineered especially for fan and blower service. Refined over the years to meet the *many* exacting needs of such service. It is THE bearing to tie to for product dependability, *as proved in a million installations.* WRITE for literature and details.




- Ideally suited to domestic units. Shaft sizes from 3/4" to 1¼".
- Self-oiling composition bushing feeds oil to shaft by capillary action. Bushing shoulder provides self-lubricating bearing surface for collar.
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CALL THE TRANSMISSIONEER, your local Dodge Distributor. He's factory-trained to help solve your power drive problems. Look for his name under "Power Transmission Machinery" in your classified telephone directory.

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### Easy does it

Some low-temperature insulation materials are contrary as a mule. It's a major effort to get them properly into place and sealed against moisture.

Novoid Corkboard is different. Novoid is not only efficient—it actually helps the job along.

To start with, Novoid is light in weight—easy to handle. It's strong and solid, so you don't have to waste time trying to keep it from packing down or leaking out. It's flexible—fits over slight irregularities of surface without special shaping—doesn't crumble if it's unevenly loaded. Since Novoid Corkboard is cellular, it doesn't soak up moisture; and the vaporproofing job is simple.

Every one of these factors saves labor time, and that saves money for you. When you're planning an insulation job, it pays to call in a Novoid contractor. We'll be glad to furnish names. Novoid Cork, Englewood, N. J.

**Consider EVERY factor when you buy insulation—and you'll buy NOVOID**

**Check list of insulation properties**

| | Novoid Cork Insulation | Many Other Insulations |
|---|---|---|
| First cost | moderate | low to high |
| Installation cost | low | moderate to expensive |
| Eventual cost | low | high |
| Efficiency | remains high | generally deteriorates |
| Moisture resistance | excellent | some good, some poor |
| Vapor seal | simple | complicated or difficult to install |
| Structural strength | very good | some non-existent, others fair |
| Weight | very light | varies |
| Resilience | considerable | from fair to complete rigidity |
| Settling | none | a serious problem |
| Supporting structure | none | elaborate |
| Fire resistance | good | excellent to poor |
| Vermin resistance | good | excellent to very bad |
| Odor absorption | none | some are regular sponges |

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. . . Eliminates objectionable cold air blast at every start. Personnel directors say this extra feature is especially appreciated by employees.
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scheduled and additional information may be obtained from Dr. Gaillard at 400 W. 118 St., New York 27.

*INTERNATIONAL ENGINEERING CONFERENCES AND EXHIBITION*—International meetings to be held in India during January are the Fourth Congress on Large Dams, the sectional meeting of World Power Conferences, the meeting of the International Association of Hydraulic Research, and a conference of the newly formed International Commission on Irrigation and Canals. An exhibition of engineering activities in these fields will be held at the same time. Additional information may be obtained from the Consulate General of India, 3 E. 64th St., New York 21.

*AMERICAN SOCIETY FOR TESTING MATERIALS*, 1916 Race St., Philadelphia 3—National meetings scheduled for 1951 are the spring meeting and committee week, March 5 to 9, Cincinnati, and the annual meeting, June 18 to 22, Atlantic City. The 1952 spring meeting and committee week will be held, March 3 to 7, in Cleveland and the 1952 annual meeting is scheduled for June 23 to 27 in New York City.

*INTERNATIONAL INDUSTRIAL EXPOSITION*—March 11 through 17, the Coliseum, Houston, Tex. According to the exposition management, located at 41 San Jacinto St., Houston 2, exhibits will cover oil, refining, chemicals, metals, machinery, power, material handling, welding, and instruments, as well as electrical, safety, and marine equipment.

*NATIONAL ASSOCIATION OF CORROSION ENGINEERS*, 919 Milam Bldg., Houston, Tex.—The 1951 conference and exhibition will be held at the Hotel Statler, New York City, March 13 to 16, and plans are now underway for the presentation of 39 technical papers.

*AMERICAN FOUNDRYMEN'S SOCIETY*, 616 S. Michigan Ave., Chicago 5—The 55th annual convention will be held in Buffalo, N. Y., April 23 to 26.

*AIR POLLUTION AND SMOKE PREVENTION ASSOCIATION OF AMERICA*—The 1951 annual meeting will be held May 6 to 10, Roanoke, Va.

*HEATING, PIPING & AIR CONDITIONING CONTRACTORS NATIONAL ASSOCIATION*, 1250 Avenue of the Americas, New York 20—The 62nd annual convention, Washington, D. C., May 8 to 11.

*AMERICAN INSTITUTE OF ARCHITECTS*, Washington 6, D. C.—The 1951 convention and national seminar meetings will be held May 8 to 11, Edgewater Beach hotel, Chicago. For the first time in 83 years a product exhibition will be held in conjunction with the affair. According to the institute, only those building products or methods recently placed in production or shortly to be offered commercially will be granted space.

*NATIONAL DISTRICT HEATING ASSOCIATION*, 827 N. Euclid Ave., Pittsburgh 6—The 42nd annual meeting will be held June 5 to 8 at the Statler hotel, Detroit.

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Hot and chilled water circulating
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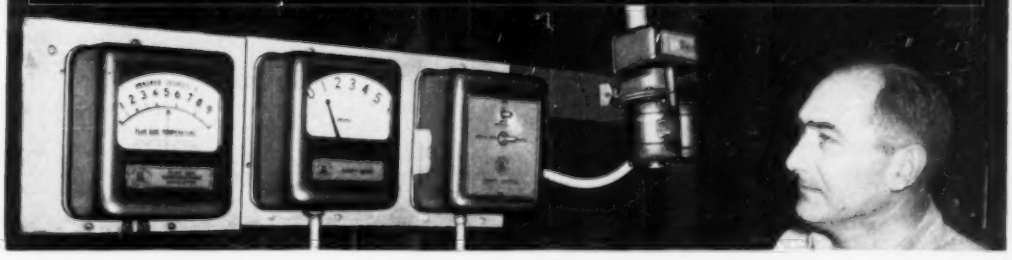

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**A completely engineered centrifugal type ventilator for efficient duct exhaust against static pressure**

The low operating noise levels required in ventilation equipment for public, commercial and industrial buildings are attained by the Airlift without sacrificing exhaust efficiency.

Powered by perfectly balanced centrifugal type fans carrying NAFM certified ratings, the 14 sizes provide nearly 50 capacity variations by selective use, at the factory, of different fan speeds and motor horse power.

Airlift features an outstanding improvement in ventilator fans and in overall structural efficiency. The streamlined fan bottom forms a smooth path for the air-flow from inlet to blades; close over-lapping of fan and throat eliminates loss of suction effect. Absence of turbulence at fan inlet and in the ventilator's exhaust area is a result of careful engineering that adds to the unit's quietness and effective operation. Be sure to get full details of this low noise ventilator. Write for Bulletin 341F.

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**The Swartwout Co.**

**Industrial Ventilation Specialists Since 1904**

Equipment for *Controlled* Air Circulation


# RECENT TRADE LITERATURE

*For your convenience in obtaining copies of these bulletins, see coupon on page 177. If you write direct to the manufacturer, describe carefully what literature you want, as the number given first in each item is for use only when sending requests to Heating, Piping & Air Conditioning*

### Air Conditioning Units

HPAC 101—Catalog No. 7550 of Young Radiator Co., Racine, Wis., gives full details about the new "YAC" air conditioning line. The units are stocked in 8 sizes, horizontal or vertical types, and provide any combination of service desired from simple heating and cooling to complete air conditioning. Capacities range from 400 cfm to 16,625 cfm under standard conditions. The booklet covers the advantages of the sectional design and presents roughing-in dimensions, as well as physical and capacity data.

### Air Diffusers

HPAC 102—A new four page folder (Bulletin 32), describing how to apply its air diffusers in textile plants, has been prepared by Anemostat Corp. of America, 10 E. 39th St., New York City. The folder tabulates factors governing atmospheric conditions in textile installations which are essential for the manufacture, processing and preservation of goods, and for personnel efficiency.

### Air Washers, Humidifiers, Dehumidifiers

HPAC 103—Spray type air washers, humidifiers, and dehumidifiers are covered in a new bulletin (No. 7) of Buensod-Stacey, Inc., 60 E. 42nd St., New York City. Complete specifications and sizes are given and the company's rotary strainer is also described. This unit is designed for use in applications where lint must be removed from spray water before the water is recirculated through the spray nozzles.

### Boiler Feedwater Treatment

HPAC 104—Bulletin W-212B7 on the "Hot-Z" system for treating boiler feedwater is now available from Worthington Pump & Machinery Corp., Harrison, N. J. The bulletin discusses the development, filtration, backwash water, direct contact vent condenser, complementary recirculation, backwashing, proportionate sludge removal and applications.

### Centrifugal Pumps

HPAC 105—Centrifugal pumping units for virtually every industry are cataloged in a new 16 page bulletin (52B6059G) of Allis-Chalmers Mfg. Co., 1171 S. 70th St., Milwaukee. A wide variety of units are indexed in this bulletin, including close-coupled, pedestal, double suction single stage, multi-stage, self-priming, fractional horsepower, coolant and circulating, fire, process, solids handling, marine, rubber lined, paper pulp, sewage, axial and mixed flow types. Head capacity charts and tables for the various types are given along with data on sizes, capacities and construction features.

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# "CORRECT PRACTICE in INDUSTRIAL PIPING"

**197 Pages — 8½" x 11" — $1.50**

This practical book is made up of outstanding papers and data on industrial piping selected from past issues of "Heating, Piping & Air Conditioning." It is a most comprehensive collection of case studies, showing how various difficult piping problems encountered in different industrial plants were successfully worked out by piping experts.

Design, installation, operation, and maintenance . . . steam, air, gas, oil, process, water and refrigeration piping . . . piping in pulp and paper and steel mills, in automobile plants and breweries, in the food and chemical and textile industries, and in many other types of manufacturing plants are dealt with from many different angles.

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- **Advanced Engineering**—Known as a leader in its field for many years, Skidmore Pumps are still first with the latest in pump engineering features.
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Type VC Condensate Pump

- **New Bulletin No. 10-B**

Send for your copy of the Skidmore VC Condensation Pump bulletin which gives complete information and engineering data on this pump—or information on any other type Skidmore Pumps will be sent on request, without obligation.

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# NEWS ITEM!*

* Two of the three Phillips Towers erected on the 19th, 24th and 46th floors of Garment Center Capitol as a part of New York City's water conservation program.

George Metz, Manager of the Garment Center Capitol, will effect a 340,000 gallon water saving hourly during the operation of the building's 2000 tons of air conditioning.

This chilled water system made available to all tenants of this busy loft building in mid-town New York was designed by Sears & Kopf (Consulting Engineers), Andrew Monaghan, supervising, and installed by Jarcho Bros. Inc., Air Conditioning Contractors.

Cooling Towers were fabricated in the Phillips plant in Brooklyn within sight of the Garment Center Capitol. All rigging and erection including that for the 46th floor tower which had to be lifted over the 12 foot parapet was handled by Phillips own engineers and riggers. All towers were built of galvanized steel and corrugated transite to minimize maintenance.

Phillips Towers are also available in all sizes (ABOVE 15 TONS) in Transite, California Redwood, or All-Steel Construction.

Phillips Cooling Tower Co., Inc.
220 DUPONT ST., BROOKLYN 22, N. Y.


### Close Coupled Pump Unit

HPAC 106—Design and construction features of the "Electrifugal" close coupled pump and motor are described in a new bulletin (52B6140B) released by Allis-Chalmers Mfg. Co., 1176 S. 70th St., Milwaukee. The unit has a single shaft mounted in a unit-cast frame designed to assure perfect and permanent alignment and is available with drip-proof, splashproof, totally enclosed, fan cooled, or explosionproof motor enclosures. The pumps are available in ratings from 10 to 500 gpm at heads to 220 ft. Motors are rated from ¾ to 10 hp.

### Corrosion of Brass Pipe, Copper Tubing

HPAC 107—A new two page folder of Water Service Laboratories, Inc., 423 W. 126th St., New York 27, discusses the corrosive effect of water on the different kinds of brass pipe and on copper tubing, and describes water treatment to check corrosion.

### Dust and Fume Control

HPAC 108—Dust and fume collectors for use in the mining and metallurgical industries are described and illustrated in Bulletin 282 of American Wheelabrator and Equipment Corp., S. Byrkit St., Mishawaka, Ind. The bulletin describes the operation of cloth tube type collectors used in connection with handling gases from roasters, sintering machines, induction furnaces, etc. According to the bulletin, uniform recoveries in excess of 99 percent by weight of the fume entering the collector are being effected, and the collected material can be reprocessed without dewatering, filtering, or drying.

### Emergency Controls for Regulating Valves

HPAC 109—Swartwout Co., 18511 Euclid Ave., Cleveland 12, has released Bulletin S-31 describing its air locks and trip master controls for holding regulating and control valves in position during failure of air supply. The bulletin describes the operation of equipment and lists various applications. It also states that in many cases if the air supply for the control system fails, all valves should lock in position at the same instant to preserve the correct ratio. In pressure reducing and desuperheating stations, for example, the steam temperature may rise or fall if the water valve locks in position ahead of the pressure reducing valve. This, says the company, might cause serious damage to low temperature piping or equipment.

### Exhauster Fan

HPAC 110—Performance data, dimensions, and details on design and construction features of the new type AE exhauster are given in Bulletin 5100 of Robinson Ventilating Co., Zelienople, Pa. The unit is recommended for many applications such as dust exhaust systems, smoke and fume exhaust systems, recirculating systems for heat treating furnaces, annealing ovens, etc.

### Expansion Joints

HPAC 111—Examples showing typical installations and various applications of "MagniLastic" expansion joints are illustrated in the Vol. 2, No. 11 issue of the house organ published by MagniLastic Div., Cook Electric Co., 2700 Southport Ave., Chicago 14.

## YOU GET *BOTH* WITH AUTORAD

- ***EASY INSTALLATION FOR YOU***
- ***LASTING CUSTOMER SATISFACTION***

There may be cheaper types of baseboard radiation than AUTORAD but in no other finned type heating equipment can you get finer engineering design, better materials and fabrication, and beautiful appearance. All-steel construction makes bond between fins and pipe **permanent.** No electrolytic action or expansion differences can loosen the fins and reduce heat transfer. Fin spacing is ample for self-cleaning.

On your next job of new construction or remodeling, try AUTORAD. It will build business for you by the satisfaction it gives.

**AUTORAD Finned Pipe**

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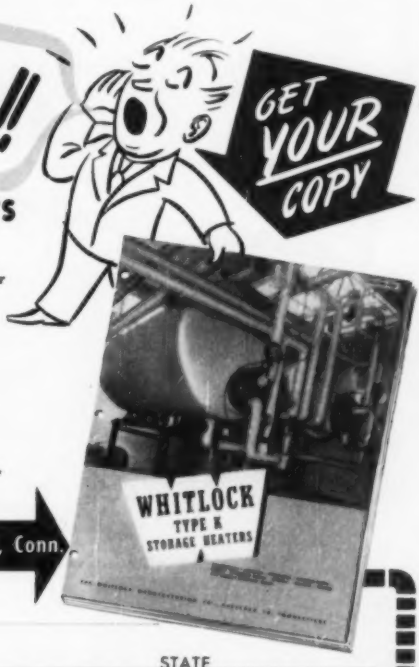
## *New* BULLETIN *JUST OFF THE PRESS!!*




## WHITLOCK Type K Storage Heaters

Here's a new bulletin that's the "book of the month" for those responsible for hot water in hospitals, laundries, colleges, and industrial plants. Whitlock specializes in the design and construction of storage water heaters. Clip the coupon and profit by our experience — it costs you nothing and can save you real money! Do it now!

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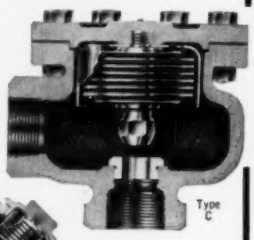
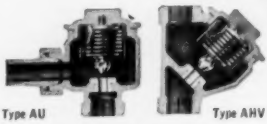
**MORE UNIFORM HEATING CYCLES**

with Nicholson Steam Traps

The positive action of Nicholson traps was recently used successfully by a chemical maker to smooth out the heating cycles of cookers at 50 to 60 minutes, against previous periods up to 105 minutes. Steam flow was upped to 3000 lbs. an hour against 2000 for the previous mechanical type.

5 TYPES FOR EVERY APPLICATION, process heat power. Sizes ¼" to 2"; pressure to 225 lbs. Send for Bulletin 450.




BULLETIN 450 or see Sweet's

W. H. NICHOLSON & CO. 198 OREGON STREET WILKES-BARRE • PA.

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### Fastening Specialties

HPAC 112—Bulletin SCO 12 of South Chester Corp., 1418 S. Penn Sq., Philadelphia 2, describes a line of fastening specialties which includes blind rivets, anchor nuts, screw fasteners, adjustable pawl fasteners, and door retaining springs.

### Flexible Metal Hose

HPAC 113—Catalog 500 of Atlantic Metal Hose Co., Inc., 123 W. 64th St., New York 23, describes and illustrates flexible metal, interlocking high pressure hose, conveyor hose for ventilating and exhausting, flexible metal seamless high pressure hose, diesel exhaust hose, metal lined gasoline hose, and synthetic rubber gasoline hose. Also included is the U. S. Navy Dept. test table for bronze and steel hose, together with data on bending diameters, hydrostatic bursting pressures, and a series of installation diagrams.

### Flow Regulator

HPAC 114—A cutaway illustration in color, which explains the operation of its direct acting flow regulator, is the chief feature of Bulletin No. 502 issued by W. A. Kates Co., 430 Waukegan Rd., Deerfield, Ill. The unit is self contained, independent of air lines, electric current, remote valves or other apparatus and is available for controlling the flow of water, acids or oils at high or low temperatures and high or low pressures. Specifications are given for regulators having capacities from 0.1 to 100 gpm, and according to the bulletin, larger units are also available.


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You Sell BOTH Markets with ALDRICH HEAT-PAK BOILER-BURNERS

Expand your market to 90% of new home construction with Aldrich. Sell more, with less inventory . cash in with oil units, cash in again with gas burners.

Mounting plates are similar; installation is fast and simple. And you can convert from one fuel to another without changing boiler set-up or performance.

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Aldrich Heat-Pak boilers come in 7 sizes, from 100,000 to 808,000 BTU/hr. With both oil and gas, you have 14 compact heating plants to sell everything from modern small homes to big commercial installations. Vertical-type, compact and efficient; shipped crated fully assembled, ready to set in place and connect.

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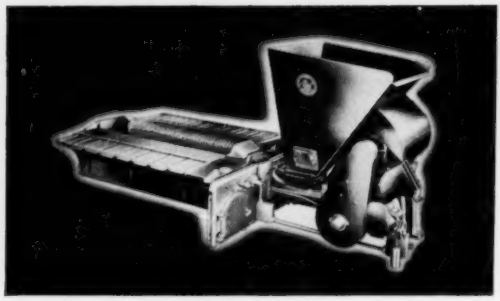
Right now The Advertising Council has 14 programs in operation. The success of these programs depends on the public spirited and generous cooperation of advertisers and media owners. *Your* help, in the form of space or time donations, will mean a lot to us. And remember . . . *What helps America helps you!*

**Yours for the Asking**

Write for a copy of Booklet No. 15. It will give you pertinent information about The Advertising Council . . . how it started . . . what it is . . . what it does . . .Or ask for material on specific campaigns. Address: — The Advertising Council, 25 West 45th Street, New York 19, N. Y.

**Heating, Piping & Air Conditioning**
**6 North Michigan Avenue**
**Chicago 2, Illinois**

*A NON-PROFIT ORGANIZATION FORMED TO UTILIZE ADVERTISING IN THE PUBLIC GOOD



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The present-day Brownell Ramfeed Stokers incorporate the latest improvements along with the original basic design. Many years of experience have proved that this stoker leaves nothing to be desired in efficient, economical, dependable, enduring coal-burning performance.

Made in standard and low-set models, the machines have capacities ranging from 75 to 560 boiler h.p. Each of the twelve sizes has eight feeding rates to meet load variations. Automatic control of coal feed and for air intake is available. The ram stops at innermost position to block gas blow-back. Fuel is evenly distributed and agitated for complete combustion.

Ask for Bulletins S-31 and S-32 describing these heavy-duty stokers.

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### Gearmotors and Helical Gear Drives

HPAC 115—Link-Belt Co., 307 N. Michigan Ave., Chicago 1, has developed a new packaged power unit, called "Motogear", consisting of an enclosed helical gear drive with a separate standard motor, flexibly coupled and mounted on one welded steel base plate. Complete information on these units, together with the company's gearmotors and separate helical gear drives, 1 to 75 hp, is given in a new 16 page booklet, No. 2247.

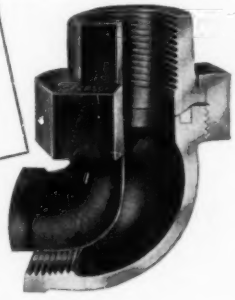
### Hardfacing Welding Alloys

HPAC 116—A new hardfacing catalog is available from Air Reduction Sales Co., Div. of Air Reduction Co., Inc., 60 E. 42nd St., New York 17. The 20 page, illustrated catalog contains detailed information on the company's complete "Airco" line of hardfacing alloys. Information is given on typical uses, mechanical properties, chemical analyses, and recommended procedures.

### Heat Exchangers

HPAC 117—A new price list (No. 104) of Heat-X-Changer Co., Inc., Brewster, N. Y., covers various types of coolers, including heavy duty liquid coolers (for use where the outlet water temperature is 40 F or higher) and heavy duty coolers with circulating pumps for use where outlet water temperatures are 25 to 40 F. Also covered are combination air and water cooled condensers, remote type combination condensers (complete with fans and motors), water cooled condensers, tube cleaners, heat interchangers, shell and tube type condensers of 15 to 100 tons capacity, and shell and coil condenser receivers. Also released is a new price list and data sheet on water


*Simplify* PIPING MAINTENANCE



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Standard switches are rated at 15 amps 125/250 V. AC. Switches rated at ¾ hp 125 V. AC, 1½ hp 250 V. AC are also available.

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Whatever your control problem may be, United Electric Controls Co. is prepared to assist you. Send full details and drawings. Write for bulletin giving complete details on the control mentioned above.

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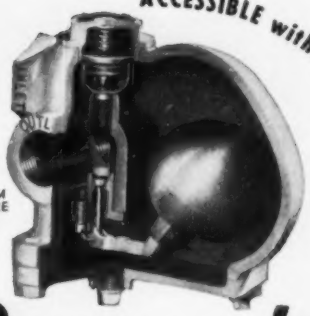

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Working parts are readily accessible without the use of special wrenches or disconnecting the trap from the pipe lines. Made in five sizes for handling large and sudden loads of condensate. Low, Medium and High Pressure modifications.

See your B & J specialist for information on Radiator Valves, Thermostatic Traps, F & T Traps, Boiler Return Traps. Send for Catalog 76 today.

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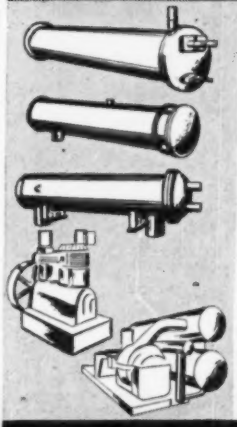

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cooled condensers with short lengths for self contained air conditioners.

### Industrial Radiography

HPAC 118—A direct reading exposure chart for gamma radiography, in connection with cobalt 60 radiography of castings, is available from St. John X-Ray Laboratory, Califon, N. J. According to the company, recent developments make it possible to radiograph greater thicknesses of steel, use larger source to film distances, and allow longer exposure time than have been commercially used with radium. These factors and certain changes in photographic materials during the past years were responsible for the preparation of this new chart.

### Industrial Temperature Control

HPAC 119—Bulletin 101 of Partlow Corp., New Hartford, N. Y., covers basic principles of industrial temperature control. The different types of control systems are defined and descriptions are given on eight ways of responding to temperature, five ways of putting that response to work, and nine basic instrument types offered by the company. Also included are comparisons of systems and various considerations in regard to application engineering. Information is given on the influence of the firing system upon the design of the control system, the fundamentals of the mercury-bulb installation, and basic concepts of electrical and mechanical control theory. Some of the topics described include the control circuit versus the load circuit; one-point, two-point and program control; two-wire, three-wire and potentiometric control; two-position control; the use of diaphragm valves; etc.

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It shows complete line of Unit Heaters of portable, mounted and built-in-wall types.
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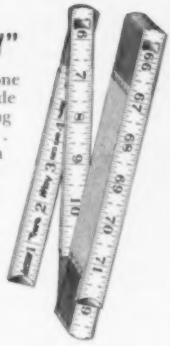

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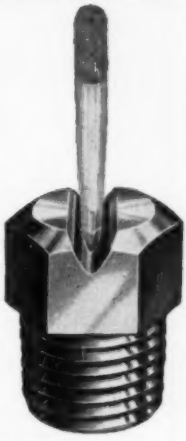

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GENERAL OFFICES, 31st & WALNUT STS., PHILADELPHIA 4, PA.

Typical circuits and piping arrangements, together with ranges and calibrations of scales and dials, are dealt with diagrammatically.

### Protection of Cooling Towers

HPAC 120—An article on the delignification of wood in cooling towers tells how water treatment can prevent deterioration of cooling tower structures. The article is featured in the Vol. 19 No. 9 issue of the house organ published by W. H. & L. D. Betz, Gillingham & Worth Sts., Philadelphia 24.

### Pumps for Corrosive Fluids

HPAC 121—Rotary pumps recommended for handling acids, alkalies, industrial alcohols, together with other corrosive liquids and gases, are described and illustrated in a four page bulletin issued by Vanton Pump Corp., Empire State Bldg., New York City 1. The fluid being transferred does not touch metal parts. The liquid or gas passing through the unit is in contact only with the molded hard rubber or plastic body block and the "Flex-I-Liner", which is actuated by a rotor mounted on an eccentric shaft creating a "squeegee" pressure action and resulting in a positive displacement of the fluid. The liner is made of pure gum rubber, Buna M, Hycar or other materials.

### Railway Air Conditioning Batteries

HPAC 122—Gould-National Batteries, Inc., Trenton, N. J., has prepared a six-page bulletin on storage batteries for railroad car lighting and air conditioning. Two pages are devoted to the new positive "Z" plate which is said


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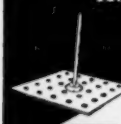
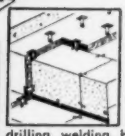
SURFACE ANCHORS AND ADHESIVES





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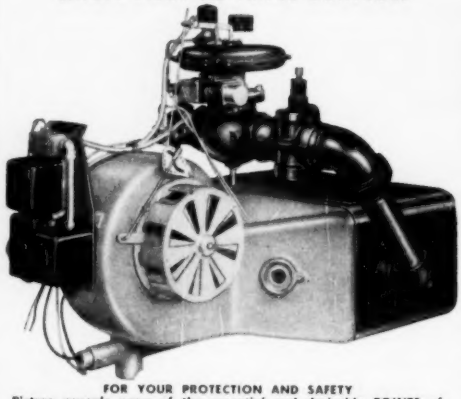
The Mettler "FAN-AIR" Gas Burner
LATEST MODEL FEATURES NEW AUTOMATIC SAFETY PILOT and TRIPLE CONTROLS



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Picture reveals some of the essential and desirable POINTS of FAN-AIR MECHANICAL DRAFT GAS BURNERS. Not just a burner but a COMPLETE and FULLY AUTOMATIC GAS BURNER SYSTEM, factory tested and ready for application when received. Furnished complete as pictured with simple, dependable automatic "On and Off" or modulating controls. Burner and Controls WITH SPARK IGNITION and FLAME SAFEGUARDS are scientifically coordinated to provide INSTANT FUEL SHUT-OFF on FLAME FAILURE—MEETING APPROVAL REQUIREMENTS. Why be satisfied with less—when all these tangible advantages are so readily available. Sizes 5 to 500 H.P.

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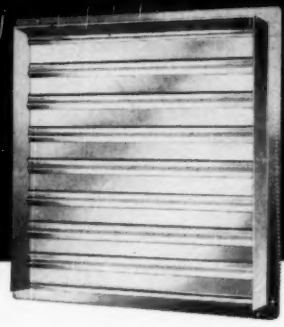

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Has it ever occurred to you that when you buy heating equipment you should ask, "How much does it pay?" rather than "How much does it cost?"
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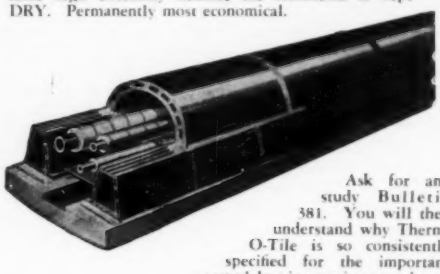
**Underground Steam Conduit**

Therm-O-Tile is a *permanent* structure. Always the same slope, hence no condensation pockets. Always the same high efficiency because the insulation is kept DRY. Permanently most economical.



Ask for and study Bulletin 381. You will then understand why Therm-O-Tile is so consistently specified for the important central heating projects as shown in this journal for many years.

*Sold and installed by Johns-Manville Construction Units in all Principal Cities.*

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**New Haven 8, Connecticut**

*Pioneer Manufacturers of Square Finned Tubing in the United States*

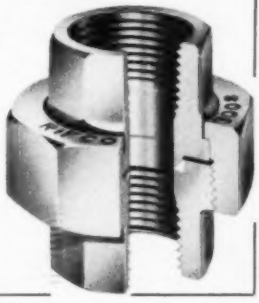
*for* **HIGH** *pressures or temperatures*

*it's the* **RIFCO 300**

**The Rifco 300 union is a rugged quality product especially suitable where high pressures or temperatures are encountered. Heavily constructed throughout, with thick pipe ends and nut it will absolutely meet 300 lbs. pressure for steam or 400 lbs. for oil, water or gas.**

**The bronze seat is an integral part of the unit, but the 300 is also available in All Iron Seat.**

**The Rifco 300 will put an end to fitting worries. Please write us today for more information.**



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14 different styles for Air Conditioning have recently been Standardized...Write for Catalog with over 150 illustrations.

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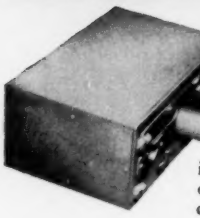
A "Double Feature" BURNER



The Siemon Gas Burner is an extremely efficient heavy duty burner, which can be installed as a straight gas burner or in combination with an oil burner, or oil can be added later. Maximum dependability and economy — completely automatic.

Siemon Combi-Matic BURNER
COMBINES OIL WITH GAS

NEW CONVERSION BURNER

A conversion burner with many new features at an economical price offering maximum efficiency.

WRITE FOR LITERATURE AND DETAILS

SIEMON & CO., 1819 Holmes St., Kansas City, Mo.


to add extra life to this industrial type storage battery. Specification tables give amp-hr capacities at both the 8 and 3 hr rates of discharge for 25 different models. Battery dimensions and weights are also tabulated and line drawings show how to connect cells in series.

### Shielded Arc Welding

HPAC 123—Bulletin 1303-5M of Lincoln Electric Co., Cleveland 1, Ohio, describes the new "Manual Lincolnweld". This new shielded arc welding tool is a lightweight welding gun designed to feed both electrode and granular flux automatically.

### Solenoid Operated Valves

HPAC 124—Automatic Switch Co., 379-B Lakeside Ave., Orange, N. J., has released a 72 page catalog (No. 23) describing its line of "Asco" solenoid operated valves for controlling the flow of liquids and gases. The booklet contains technical data and gives list prices on all standard valves. It consists of 10 sections covering safety shutoff and manually reset valves, both packed and packless valves, three-way valves, two- and three-way pilot controlled valves, four-way valves, and filters and strainers. Flow charts for water, air, gases and steam are included.

### Stainless Steels in Hospitals

HPAC 125—The eighth in a series of industry booklets, prepared by Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, deals with the past, present and future of stainless steel in the nation's hospitals. A fea-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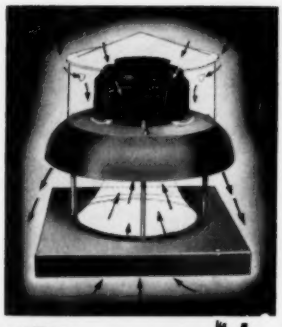
Positive air expulsion using squirrel-cage fan.

Negative air flow through motor hood prevents formation of explosive or corrosive fumes.

Heaviest construction of any similar device. SPECIAL metals for unusual conditions.



NEW Rugged! GALLAHER Air Vac POWER EXHAUSTERS

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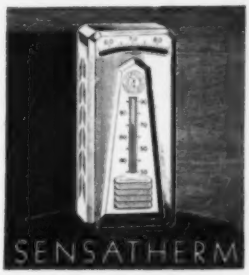


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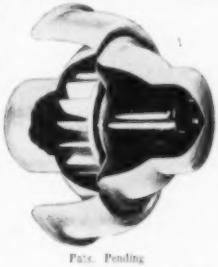

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Statement of Ownership and Management of

HEATING, PIPING & AIR CONDITIONING

for October 1, 1950

The following is a statement of ownership, management, etc., as required by the act of Congress of August 24, 1912, as amended by the acts of March 3, 1933 and July 2, 1946 (Title 39, United States Code, Section 233) of Heating, Piping & Air Conditioning, published monthly at Chicago, Ill., for October 1, 1950:

1. The names and addresses of the publisher, editor, managing editor, and business manager are:

Publisher, F. P. Keeney, Chicago, Illinois.

Editor, C. M. Burnam, Jr., Chicago, Illinois.

Managing Editor, C. M. Burnam, Jr., Chicago, Illinois.

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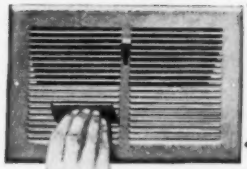
F. P. Keeney, Publisher.

Sworn to and subscribed before me this 18th day of September, 1950.

Grace E. Waymire.

(SEAL) [My commission expires February 10, 1954]



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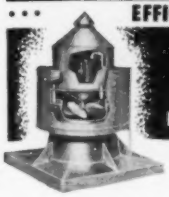

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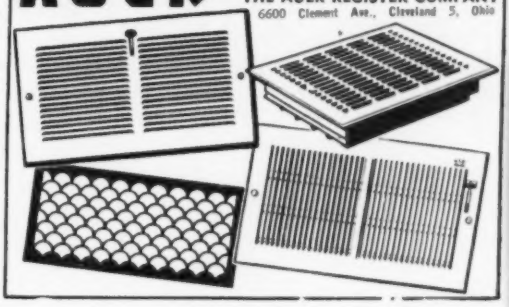


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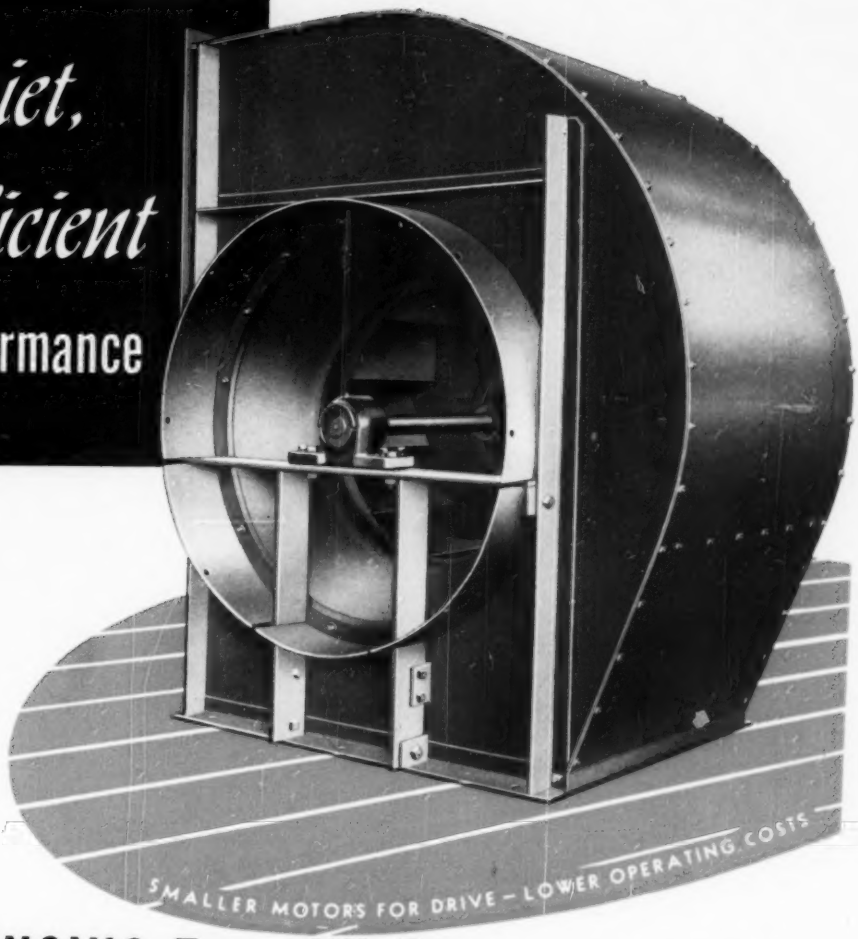


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**CLARAGE FAN COMPANY**
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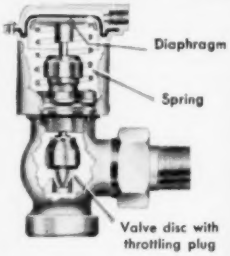
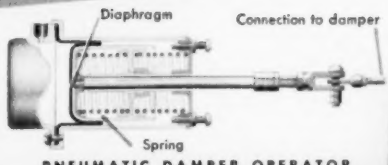
## for example... JOHNSON pneumatic temperature CONTROL

PNEUMATIC ROOM THERMOSTAT




DIAPHRAGM VALVE




PNEUMATIC DAMPER OPERATOR

Mechanical equipment which is as simple as possible, commensurate with the requirements which it has to meet, is always the most satisfactory. That is the keynote in designing JOHNSON Automatic Temperature Control apparatus. Each piece of Johnson equipment is just as simple as it is possible to make it. Thousands of Johnson installations, serving for years without end in schools and almost every other conceivable type of building, attest to the wisdom of that policy.

Each Johnson *Individual Room* Thermostat is merely a reducing valve in a compressed air line, set and reset automatically by an accurate bi-metallic temperature measuring element, to transmit compressed air, at varying pressures, to the valves and dampers which it controls. Johnson Diaphragm Valves and Damper Operators, too, are simple devices, with a flexible, long-life diaphragm which is inflated as the thermostat transmits increased air pressure and deflated by a rugged opposing spring when there is a drop in the air pressure. There are no mysteries here. And no complications!

To supply power for the operation of the apparatus in a Johnson installation, a small air compressor in the basement automatically maintains the required air pressure in the system of small tubing, concealed in the walls, which delivers compressed air to each thermostat and connects the instrument to the regulators which it operates. Quiet, safe, dependable! And only one electric motor in the entire installation to look after and to feed with electricity.

**CONTINUOUS DEVELOPMENT...** The Johnson research and development laboratories not only pioneer in modern advancements but painstakingly ferret out and test all new principles which might be applied to the field of automatic temperature control. Johnson engineers are "Johnny-on-the-spot" in suggesting improvements. IF AND WHEN new developments prove themselves, then—and only then—Johnson manufactures and installs apparatus of new design.

To get a clear picture of temperature control efficiency, call a near-by Johnson engineer. He will cooperate in solving your temperature regulation problems. And there is no obligation whatsoever. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities

# JOHNSON *Automatic Temperature and Air Conditioning* CONTROL

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885